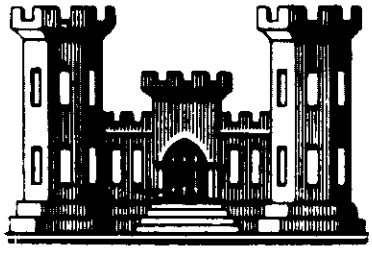
POST FLOOD REPORT

FOR

FLOOD OF 18-25 MARCH 1968

IN NEW ENGLAND



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

AUGUST 1968

POST FLOOD REPORT

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Department of the Army
New England Division, Corps of Engineers
Waltham, Mass.

August 1968

NEW ENGLAND FLOODS OF MARCH 1968

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NEW ENGLAND FLOODS OF MARCH 1968

PART I - HYDROLOGY

1. STORMS

a. General. The 1967-68 winter produced various climatic conditions contributing to the flood which occurred during the latter part of March 1968. Periods of prolonged cold spells in early January and again in February resulted in a deep penetration of frost and thick ice cover on lakes and rivers. Snow cover was above normal in southern New England and about average in northern areas. Water content of the snow for the week of 4 March 1968 is shown on plate 1. A large part of the snow cover in southern areas had melted prior to the rainstorm of 17 and 18 March. This snowmelt had saturated swamps and low meadowlands and already produced above normal streamflows. In northern areas ice still remained solid in the lakes and rivers and temperatures were not high enough to cause any appreciable snowmelt.

b. Storms. Heavy rainfall occurred over New England starting on Sunday, 17 March and continuing through Monday, 18 March. Highest amounts of precipitation were recorded in southeastern areas where 5 to 7 inches fell in the triangular area formed by Boston, central Rhode Island and Cape Cod Canal. Areas further west and north received diminishing amounts but practically all New England had a minimum of 1 inch.

An isohyetal map for the storm of 17-19 March, based on data

furnished by the U. S. Weather Bureau, is shown on plate 2. Mass rainfall curves from several recording precipitation stations are shown on plate 3. The following table presents total rainfall data in southern and central New England:

TABLE I

TOTAL RAINFALL AT SELECTED STATIONS
FOR STORM OF 17-19 MARCH 1968

Station	Total (inches)	Station	Total (inches)
MASSACHUSETTS		CONNECTICUT	
Blue Hills	7.7	West Thompson Dam	3.8
Hingham	7.0	Putnam	3.6
Falmouth	6.9	Jewett City	3.5
Cohasset	6.5	Mansfield Hollow Dam	2.2
South Weymouth	5.7	New Haven	2.0
West Hill Dam	5.1	Hartford	1.7
Boston	5.1	MAINE	
Worcester	4.9		
Natick	4.8	Portland	2.4
Buffumville Dam	4.5	NEW HAMPSHIRE	
North Reading	4.0		
Lowell	3.0	MacDowell Dam	3.7
		Portsmouth	3.4
East Brimfield Dam	2.7	Hopkinton Dam	3.0
Birch Hill Dam	2.7	Otter Brook Dam	1.7
Knightville Dam	2.5		
		VERMONT	
RHODE ISLAND			
		Ball Mountain Dam	2.1
Woonsocket	5.2	North Springfield Dam	1.6
Providence	5.0	Union Village Dam	1.0

On 23 March, warm temperatures and another period of shower activity released up to an inch of rainfall over the mountainous areas of northern and western portions of New England.

2. FLOODS

a. Flooding from storm of 17-18 March. Areas in southern New England where snowmelt had already produced moderate increases in riverflows were experiencing the highest amounts of runoff as a result of the rainfall of 17-18 March. Major floods immediately developed in most river basins in southeastern New England and are listed below:

Rivers	States
Thames (French, Quinebaug and Shetucket)	Massachusetts, Connecticut
Pawcatuck	Rhode Island
Pawtuxet	Rhode Island
Woonasquatucket	Rhode Island
Blackstone	Massachusetts, Rhode Island
Taunton	Massachusetts
Neponset	Massachusetts
Charles	Massachusetts
Ipswich	Massachusetts
Concord	Massachusetts

Record peak discharges were recorded at several gaging stations. Throughout the entire Charles River basin this flood either equaled or exceeded record discharges associated with the March 1936 or August 1955 floods. On the Concord River at Lowell, Massachusetts (312 square miles) the peak flow of 4,900 cfs exceeded the record August 1955 discharge of 4,540 cfs. Maximum floods of record also occurred in the Taunton, Pawtuxet and Pawcatuck River basins. On the Blackstone River at Woonsocket, Rhode Island the flood was second only to the August 1955 event.

A summary of March 1968 flood discharges compiled by the U. S. Geological Survey is listed in table II.

b. Flooding from storm of 23-24 March. During the following weekend of 23-24 March, moderate rain combined with melting snow in western and northern New England caused the Connecticut River to reach or slightly exceed flood stages along its entire reach. Stages were also affected by ice jams at several locations, notably the Bellows Falls, Vermont area on the Connecticut River.

TABLE II

SUMMARY OF FLOOD DISCHARGES
18-23 MARCH 1968

No.	Stream and Location	Drainage Area (sq.mi.)	Period of Record	Maximum Flood Previously Known				Maximum During Present Flood*			
				Date	Stage (ft)	Discharge (cfs)	cfs per Square Mile (csm)	Time and Date	Stage (ft)	Discharge (cfs)	cfs per Square Mile (csm)
	MERRIMACK RIVER BASIN										
1	North Nashua River near Leominster, Mass.	107	1935-	18 Mar 1936	20.53	16,300	152	0600 - 19 Mar	7.97	4,000	37.4
2	Squannacook River near West Groton, Mass.	62.8	1949-	16 Oct 1955	8.04	4,010	63.9	1000 - 19 Mar	6.82	2,260	36.0
3	Nashua River at East Pepperell, Mass.	316	1935-	20 Mar 1936	19.1	20,900	66.1	2315 - 20 Mar	11.77	6,900	21.8
4	Assabet River at Maynard, Mass.	116	1941-	20 Aug 1955	8.94	4,250	36.6	1100 - 19 Mar	7.80	3,300	28.4
5	Nashoba Brook near Acton, Mass.	12.7	1963-	26 May 1967	4.11	128	10.1	1100 - 20 Mar	5.07	360	28.3
6	Concord River below River Meadow Brook at Lowell, Mass.	312	1936-	23 Aug 1955	8.97	4,540	14.6	1400 - 22 Mar	9.15	4,900	15.7
7	Merrimack River below Concord River at Lowell, Mass.	4,425	1923-	20 Mar 1936	68.4	173,000	39.1	0100 - 23 Mar	51.15	44,400	10.0
8	Shawsheen River near Wilmington, Mass.	35.1	1963-	26 May 1967	6.72	476	13.6	1315 - 19 Mar	8.60	980	27.9
9	East Meadow River near Haverhill, Mass.	4.93	1962-	6-7 Dec 1962	4.89	127	25.8	0500 - 19 Mar	5.45	210	42.6
	PARKER RIVER BASIN										
10	Parker River at Byfield, Mass.	21.6	1945-	27 Jan 1958	5.49	479	22.2	1030 - 20 Mar	5.41	470	21.8
	IPSWICH RIVER BASIN										
11	Maple Meadow Brook at Wilmington, Mass.	3.99	1962-	7 Oct 1962	5.33	103	25.8	1045 - 19 Mar	5.64	106	26.6
12	Ipswich River at South Middleton, Mass.	43.4	1938-	7 Oct 1962	6.99	808	18.6	1600 - 20 Mar	7.07	890	20.5
13	Ipswich River near Ipswich, Mass.	124	1930-	15 Mar 1936	7.70	2,610	21.0	0200 - 21 Mar	8.41	2,700	21.8
	MYSTIC RIVER BASIN										
14	Aberjona River at Winchester, Mass.	23.3	1939-	19 Aug 1955	13.64	835	35.8	0200 - 19 Mar	13.74	660	28.3
	CHARLES RIVER BASIN										
15	Charles River at Charles River Village, Mass.	184	1937-	23 Aug 1955	9.24	3,220	17.5	0115 - 22 Mar	8.72	3,200	17.4
16	Mother Brook at Dedham, Mass.	-	1931-	24 Aug 1955	92.90	970	-	- 22 Mar	86.86	990	-
17	Charles River at Wellesley, Mass.	211	1959-	5 Apr 1960	5.16	1,470	6.97	1630 - 22 Mar	6.20	2,400	11.4
18	Charles River at Waltham, Mass.	227	1931-	19 Mar 1936	4.79	2,540	11.2	0830 - 22 Mar	5.38	2,620	11.5
	NEPONSET RIVER BASIN										
19	Neponset River at Norwood, Mass.	35.2	1939-	19 Aug 1955	14.65	1,490	42.3	2400 - 18 Mar	10.45	1,050	29.8
20	East Branch Neponset River at Canton, Mass.	27.2	1952-	19 Aug 1955	8.18	1,790	65.8	1745 - 19 Mar	6.87	1,270	46.7
	TAUNTON RIVER BASIN										
21	Dorchester Brook near Brockton, Mass.	4.67	1962-	7 Oct 1962	3.6	130	27.8	1330 - 18 Mar	5.86	360	77.1
22	Taunton River at State Farm, Mass.	260	1929-	21 Aug 1955	13.02	4,010	15.4	1500 - 20 Mar	14.47	5,000	19.2
23	Wading River at West Mansfield, Mass.	19.2	1953-	20 Aug 1955	6.22	519	27.0	1100 - 19 Mar	6.60	370	19.3
24	Wading River near Norton, Mass.	42.4	1925-	20 Aug 1955	10.98	1,170	27.6	0100 - 19 Mar	11.45	1,440	34.0
25	Threemile River at North Dighton, Mass.	83.8	1966-	27 May 1967	6.31	1,340	16.0	1900 - 19 Mar	8.30	2,450	29.2
26	Segreganset River near Dighton, Mass.	10.6	1966-	26 May 1967	5.81	512	48.3	1945 - 18 Mar	7.53	890	84.0

TABLE II (continued)

SUMMARY OF FLOOD DISCHARGES
18-23 MARCH 1968

No.	Stream and Location	Drainage Area (sq.mi.)	Period of Record	Maximum Flood Previously Known				Maximum During Present Flood*			
				Date	Stage (ft)	Discharge (cfs)	cfs per Square Mile (csm)	Time and Date	Stage (ft)	Discharge (cfs)	cfs per Square Mile (csm)
	WEYMOUTH BACK RIVER BASIN										
27	Old Swamp River near South Weymouth, Mass.	4.29	1966-	26 May 1967	3.98	207	48.2	2300 - 18 Mar	5.22	580	135
	NORTH RIVER BASIN										
28	Indian Head River at Hanover, Mass.	30.3	1966-	26 May 1967	5.62	788	26.0	2330 - 18 Mar	7.18	1,410	46.5
	WEST BRANCH WESTPORT RIVER BASIN										
29	Adamsville Brook at Adamsville, R. I.	8.6	1940-	20 Sept 1960	7.135	273	31.7	1200 - 18 Mar	7.67	200	23.3
	PALMER RIVER BASIN										
30	Bliss Brook near Rehoboth, Mass.	4.96	1962-	26 May 1967	5.04	249	50.2	1115 - 18 Mar	5.43	550	111
	BLACKSTONE RIVER BASIN										
31	Blackstone River at Northbridge, Mass.	139	1939-	20 Aug 1955	16.74	16,900	122	0300 - 19 Mar	10.91	4,700	33.8
32	Nipmuc River near Harrisville, R. I.	16.0	1964-	26 May 1967	6.58	527	32.9	1930 - 18 Mar	7.42	750	46.9
33	Branch River at Forestdale, R. I.	93.3	1940-	19 Aug 1955	10.52	4,240	45.4	2300 - 18 Mar	11.90	5,600	60.0
34	Blackstone River at Woonsocket, R. I.	416	1929-	19 Aug 1955	21.8	32,900	79.1	0615 - 19 Mar	14.63	15,400	37.0
35	Blackstone River Tributary at Woonsocket, R. I.	2.22	1965-	26 May 1967	2.97	116	52.3	1100 - 18 Mar	3.52	175	78.8
	MOSHASSUCK RIVER BASIN										
36	Moshassuck River at Providence, R. I.	23.1	1963-	1 Aug 1967	4.40	1,110	48.1	0900 - 18 Mar	4.29	1,000	43.3
	WOONASQUATUCKET RIVER BASIN										
37	Woonasquatucket River at Centerdale, R. I.	38.3	1941-	11 Sept 1954	7.03	1,110	28.7	- 19 Mar	7.7	1,400	36.6
	PAWTUXET RIVER BASIN										
38	Mosquitohawk Brook near North Scituate, R. I.	3.06	1965-	26 May 1967	3.09	216	70.6	1030 - 18 Mar	3.46	410	134
39	Moosemeck River at Moosemeck, R. I.	8.23	1963-	25 Feb 1965	-	223	27.1	1800 - 18 Mar	5.55	255	31.0
40	Carr River near Moosemeck, R. I.	6.73	1963-	26 Feb 1965	4.77	96	14.3	1300 - 18 Mar	6.50	220	32.7
41	South Branch Pawtuxet River at Washington, R. I.	63.8	1940-	12 Sept 1954	4.11	1,320	20.7	2400 - 18 Mar	5.09	1,800	28.2
42	Furnace Hill Brook at Cranston, R. I.	4.19	1965-	25 May 1967	4.58	217	51.8	0100 - 18 Mar	4.67	227	54.2
43	Pawtuxet River at Cranston, R. I.	200	1939-	27 May 1967	9.95	2,360	11.8	2400 - 18 Mar	11.53	3,000	15.0
	PAWCATUCK RIVER BASIN										
44	Meadow Brook near Carolina, R. I.	5.53	1965-	7 Mar 1967	4.25	55	9.95	1300 - 18 Mar	6.07	175	31.6
45	Wood River near Arcadia, R. I.	35.2	1964-	26 Jan 1964	-	390	11.1	2100 - 18 Mar	8.64	850	24.1
46	Wood River at Hope Valley, R. I.	72.4	1941-	12 Sept 1954	7.45	1,470	20.3	2200 - 18 Mar	8.26	1,800	24.9
	THAMES RIVER BASIN										
47	Bucks Horn Brook at Greene, R. I.	5.52	1965-	*26 May 1967	3.76	144	26.1	1200 - 18 Mar	5.49	500	90.6

* Provisional Data

PART II - RESERVOIR REGULATION

1. GENERAL

All 31 Corps of Engineers flood control dams and reservoirs were operated during the two storm and flood events. Highest stages, since completion of the dams, were experienced in 10 reservoirs. In the Blackstone and Thames River basins where major flooding occurred, a detailed graphical summary of reservoir regulation and the effect at selected index stations is shown on plates 4, 5 and 6. Monthly reservoir operation charts for all reservoirs for March 1968 are shown on plates 7 through 37. A tabulation of river stage reductions at selected locations is listed in table III. Effectiveness of the reservoirs in various river basins is briefly described in the following paragraphs.

2. BLACKSTONE RIVER

West Hill Dam and Reservoir, located near Uxbridge, Massachusetts, stored all runoff from the West River during the flood. Controlling a drainage area less than 10 percent of the lower basin it is estimated that flood stages were reduced about 1 foot from Woonsocket to Pawtucket, Rhode Island.

The Worcester Diversion project on Kettle Brook, experiencing its highest flows since completion, bypassed discharges from the congested Webster Square area and Middle River in Worcester through a tunnel and channel to the Blackstone River at Millbury, Massachusetts.

3. THAMES RIVER

Five reservoirs, namely, Buffumville, Hodges Village, East Brimfield, Westville and West Thompson stored floodwaters in the upper Quinebaug

and French River watersheds. It is estimated that Buffumville and Hodges Village reduced the stage at the USGS gaging station on the French River at Webster, Massachusetts by 6 feet, a substantial reduction. At Putnam, Connecticut the effect of all 5 reservoirs lowered the river stage by $6\frac{1}{2}$ feet.

In the Shetucket River watershed, Mansfield Hollow Reservoir reduced the stage of the Shetucket River in Willimantic, Connecticut by approximately $3\frac{1}{2}$ feet.

4. CONNECTICUT RIVER

Reservoirs were regulated to restrict outflow during the first rise following snowmelt and rainfall of 17-18 March. Outflow was regulated at all dams following the additional rainfall on 23 March and development of an ice jam on the Connecticut River upstream of Bellows Falls, Vermont. The Connecticut River crested well above flood stages in areas affected by the ice jams, but about flood stage below Bellows Falls. The river was 4 feet above flood stage at Montague City, Massachusetts and approximately flood stage in southern Massachusetts and Connecticut. Without Corps of Engineers regulation, it is estimated that river stages would have been 1 to 2 feet higher. The reservoirs also effectively reduced flood stages in cities and towns on tributaries of the Connecticut River.

5. MERRIMACK RIVER

All reservoirs on the Contoocook River, namely, MacDowell, Blackwater and Hopkinton-Everett were regulated to alleviate ice jam conditions in Peterboro, New Hampshire and to control flow in the Merrimack River from Concord, New Hampshire to the mouth of the river in Massachusetts.

TABLE III

FLOOD OF MARCH 1968
EFFECT OF REGULATED PROJECTS AT SELECTED LOCATIONS

Location	Experienced Conditions Discharge (cfs)	Experienced Conditions Stage (ft)	Natural Conditions* Discharge (cfs)	Natural Conditions* Stage (ft)	Flood Stage (ft)
THAMES RIVER BASIN					
American Optical Dam Quinebaug River at Southbridge, Mass.	1,500		4,500		-
USGS Gaging Station Quinebaug River at Putnam, Conn.	3,200	7.8	11,200	14.3	11.5
USGS Gaging Station French River at Webster, Mass.	1,050	7.8	3,850	14	8
USGS Gaging Station Shetucket River at Willimantic, Conn.	4,900	8.3	10,000	11.9	10
BLACKSTONE RIVER BASIN					
USGS Gaging Station Blackstone River at Woonsocket, R. I.	15,400	14.63	16,900	15.5	9
Webster Street Bridge Middle River at Worcester, Mass.	1,000**		2,400**		-
CONNECTICUT RIVER BASIN					
USGS Gaging Station Connecticut River at Montague City, Mass.	101,500	32.1	111,000	33.7	28
Holyoke Water Co. Dam Holyoke, Mass.	94,500	9.2	103,500	9.8	9
USWB Gage Connecticut River at Hartford, Conn. (w/Bodkin Rock Discharge)	102,000	21.6	107,000	22.2	22

* Discharges and stages that would have occurred without Corps of Engineers flood control projects

** Estimated

Observed river stages in the lower basin were about 1 foot below flood levels. Without regulation, the river would have been about flood stage.

6. NAUGATUCK RIVER

Discharges were impounded in Thomaston Reservoir and the smaller ungated dam projects. Although stages in the lower Naugatuck River were reduced by several feet, flood stages would not have occurred without regulation.

PART III - FLOOD LOSSES

1. GENERAL

Damages due to floodwaters from the storm of 17-19 March were widespread and substantial although only in the case of a dam failure in East Lee, Massachusetts on the Sunday (24 March) following the storm was loss of life and a heavy concentration of damage in a small area involved. The primary storm was centered over eastern Massachusetts and in this area floodflows peaked rapidly. The northern and western fringes of the storm, bringing rain to the Connecticut River basin and western Massachusetts, set the stage for additional rainfall and melting snow in these areas late in the week of 17-23 March to apparently contribute to the dam failure and cause high flows in the Connecticut River basin with two serious ice jams resulting. There was a less spectacular dam failure in Easton, Massachusetts, a community some 15 miles south of Boston. Located above a residential area the broken dam released a wall of water which damaged over 50 homes and caused evacuation of many others.

While flood swollen streams caused much of the loss to properties adjacent to the streams, a surprising amount of damage was done to properties which the owners did not even realize were flood prone. This was brought about over the years as inland wetlands were filled in and developed for housing and industrial parks, especially in eastern Massachusetts. Many of these developments are some distance from major streams and the threat of flooding was not apparent. Moreover, the first half of the 1960 decade was a time of drought in the Northeast and

this tended to mask the problem as ground water levels were at record lows during the period. With the return to normal levels in 1967 the area needed only a major storm with rapid runoff to be in real trouble.

Generally, not too much development has taken place in recent years in the well defined flood plains of the region's major streams. This is not to say the major flood plains are vacant; the older industrial and commercial plant which originally developed the areas is still there and in some cases has expanded. These properties are so operated as to minimize flood losses and only a major flood would cause heavy damages. Only the Blackstone of the region's major streams had sizeable flood losses in the March 1968 event.

It was the region's small streams which caused the bulk of losses reported in the flood. Two factors contributed greatly to the problem, development of the wetlands, already noted, and in the built-up urban areas, a good deal of encroachment of the actual channels of the streams by dumps, parking areas and similar developments. Some measure of the effects of these trespasses on the flood plain can be grasped by noting that of 43 minor streams reported on by the Geological Survey in the March event 29 had record flows (see table 2). While the records for some of the streams are short, the trend toward increased concentration of runoff caused by urban development is marked.

2. FIELD INVESTIGATIONS

During the week of 17-23 March two-man parties were dispatched to areas with reported flood problems. Eight such parties were so used, mainly during the period of 19-24 March. Their basic mission was

observation, establishment of high watermarks for future use, usable photographs and collection of such information on probable losses as was readily available. The area covered was generally in eastern and central Massachusetts and the northern portion of Rhode Island. Following the field reconnaissance, reports covering each trip were prepared by the fieldmen with copies furnished to the Hydrology and Hydraulics Branch and Economics Section for future use.

3. LOSS ANALYSIS

The loss data used for this report are based on: (a) Stage-loss data for rivers and streams on which studies have been made in the past for survey reports, (b) analysis of photographs and reports resulting from field investigations of 19-24 March supplemented by discussions with the field personnel, (c) verifiable reports by State Civil Defense Authorities, and (d) newspaper reports and photographs.

In evaluating loss items based on newspaper reports certain unit values based on judgment and past damage surveys were used. For houses with reported basement flooding only, a unit loss of $300 was assumed. For houses which were surrounded by water the unit loss was assumed to be $1,000. No attempt was made to analyze the depreciation in value in either case. For commercial and industrial properties available data on other plants in the files were used as a guide.

For the Blackstone, French, Quinebaug, Shetucket, Nashua, Sudbury, Assabet, Concord and Shawsheen Rivers loss estimates (and damages prevented) were estimated directly from the file of the Economics Section using data on stages furnished by the Hydrology Branch.

4. FLOOD LOSSES

a. General. Estimated flood losses in the March event amounted to $45 million. The loss breakdowns by states are as follows:

Massachusetts	$35,000,000
Connecticut	100,000
Rhode Island	9,000,000
New Hampshire	800,000
Vermont	100,000

By major categories the losses amounted to:

Industrial	$ 9,500,000
Commercial	2,500,000
Residential	28,500,000
Public	4,500,000

Two lives were lost in the town of Lee, Massachusetts.

The total figure for residential losses reflects the effect of the wetlands development previously commented on. On 19 March, State Civil Defense Headquarters for Massachusetts estimated that 20,000 homes had received storm damage. Later in the week Civil Defense authorities placed the total number of homes with "basement damage" at 30 to 40,000 in all New England. About 5,000 of these homes were in the flood plains adjacent to the region's streams and could be accounted for as to amount and location. Using the lower Civil Defense estimate of 30,000 homes means losses to 25,000 dwellings in developed wetlands. The bulk of these are in Massachusetts. In evaluating losses to these homes it was noted that most would be relatively new and that current trends in

building included "family rooms" or playrooms with finished floors and walls in basements. That some of the homes would be split level was also considered. A unit loss value of $1,000 was therefore used. Some of the areas of concentrated losses are noted below.

b. Lee, Massachusetts (Housatonic River basin). The failure of a private dam at a real estate development called "Lake Lee" in the eastern part of Lee caused havoc in this western Massachusetts community of 6,000 people. A mile long section of Route Massachusetts-U.S. 20, one of the region's principal east-west roads, was badly damaged, 5 houses were destroyed, 34 other homes damaged and a medium sized industrial plant was almost gutted by the wave of water which swept down normally placid Greenwater Pond Brook and Goose Pond Brook. Two elderly people in one of the destroyed homes were killed. Losses were estimated to exceed $7 million.

c. Braintree-Weymouth area, Massachusetts. These adjoining communities on the south shore of Boston Harbor have been increasingly built over in the past two decades and have doubled their population in that period. Their combined population is approaching 90,000 people. Encroachment on the flood plain, inadequate sized culverts and high flows on Smelt Brook and Monantiquot River caused losses estimated at $2 million. The largest losses were experienced in the central business area at Weymouth Landing where depths up to 4 feet of water in the streets flooded stores and brought business to a standstill.

d. Olneyville (Providence), Rhode Island. The channel of the Woonasquatucket River in the Olneyville section of Providence has been

greatly restricted by indiscriminate dumping over the years. When the highest flow of 27 years of record occurred on 19 March the basements of several old manufacturing plants now used for storage and light industrial production by several tenants were flooded. Damages were estimated at $2,500,000 principally to stored materials.

e. Taunton, Massachusetts. This industrial city in southeastern Massachusetts was the site of a week-long emergency as city, state and Federal officials fought to prevent failure of two old dams on the Taunton River lying above the heart of the city. The area downstream of the dam was evacuated. Direct costs of the flood exceeded $900,000. This figure includes $832,000 which the Mayor of Taunton reported to Civil Defense authorities based on estimates from his department heads and covers the costs of the flood fighting plus the anticipated costs of cleanup and repairs. The business losses were not estimated. The Corps provided major technical assistance to state and local officials, at their requests, in this successful flood fight.

5. DAMAGES PREVENTED

During the flood event all flood control reservoirs in the New England Division were operated although in the case of those located in northern New Hampshire and Vermont the operation was only a precautionary measure. This also held true for the Naugatuck River basin.

In the Blackstone, Thames and lower Connecticut River basins Corps projects prevented substantial losses in communities along the main stems of the rivers and their principal tributaries.

In Canton, Massachusetts a diversion project built by the Corps

under a Section 205 authority prevented losses estimated at $2,500,000.

In the Blackstone River basin, Corps-constructed projects prevented $8 million in damages.

In the Thames River basin all Corps dams were operated effectively and damages in the amount of $7 million were prevented.

In the Connecticut River basin the system of reservoirs and local protection works prevented losses estimated at $6,500,000.

Total damages prevented during the flood amount to $24 million.

PART IV - EMERGENCY OPERATIONS

1. GENERAL

The emergency operations generated by the March floods consisted of technical assistance and advice to states and municipalities, the furnishing of sandbags to the Massachusetts Civil Defense Agency, and the survey of damages and estimates of cost of possible remedial work. The cost estimates were provided at the request of the Office of Emergency Planning. A great number of calls for information or advice were received, and the principal areas of such requests are briefly summarized in the succeeding paragraphs.

Ice jams had formed at several areas in New England during the winter causing concern as to possible flooding, particularly at the time of spring thaw and runoff. The New England Division had sent letters prior to the March flooding to the Governors of the six states advising of the possibility and the extent of assistance the Corps could provide, the limitations on such assistance, and the responsibilities of the municipalities and the states in this field. The first four specific areas of flooding or potential flooding listed below were due to or aggravated by ice jams.

2. LANCASTER, NEW HAMPSHIRE

An ice jam that had been a source of concern and was under periodic surveillance by the Corps of Engineers all winter caused flooding in the center of town. There was no destruction of structures or bridges, but damages due to submersion were significant.

3. CHERRYFIELD, MAINE

The most severe ice jam of several years threatened the U. S. Route 1 highway bridge, but broke up and went out to sea during the March thaw without damage to the bridge. There was some flooding of properties and roads adjacent to the Narraguagus River, with relatively minor damages. A Federal local protection project consisting of a dam just upriver of the center of town, built by the Corps in 1961, prevented more severe damage from ice in the upper river.

4. FRYEBURG, MAINE

Ice jams on the Saco River impounded water in the Fryeburg area to elevations threatening residential property in that region. Although the river and tributary pond areas reached levels only attained at a frequency of about 10 years, no flooding of developed property occurred. The State and local officials were advised to study the possibility of modified operation of a power dam on Saco River and other measures that might minimize future susceptibility to similar impoundments.

5. CONNECTICUT RIVER - BELLOWS FALLS, VERMONT

An ice jam in the vicinity of Bellows Falls, Vermont contributed to the rise in river levels to flood stage in March. As the jam broke and passed down river, some minor damage was occasioned along the immediate riverbanks.

6. DAM FAILURE - LEE, MASSACHUSETTS

A privately-owned earth dam built to create an artificial lake at a housing development failed suddenly a few days after the period of heavy March rains in that area. The Corps and the Office of Emergency Planning

made joint surveys of the damages caused, and estimates were furnished to the Office of Emergency Planning. The highway repairs and stream clearing were performed by the Massachusetts Department of Public Works. No direct Federal assistance was found to be required. As a result of this dam failure, the State initiated a program to review the adequacy and safety of the hundreds of private dams in the State and to establish improved criteria for construction and maintenance.

7. TAUNTON, MASSACHUSETTS

The city of Taunton informally requested and was provided around the clock advice and guidance in its flood fighting activities for over a week. The city was threatened with the imminent failure of two private dams on the Taunton River just above the center of the city. Measures suggested by the Corps advisory team at the site and undertaken by the city to relieve pressures on these dams was generally credited with the success in preserving these structures through the period of emergency.

8. SANDBAG OPERATIONS

The Massachusetts Civil Defense Administration requested and was provided 102,600 sandbags from the Corps of Engineers stockpile at Fort Devens during the 5-day emergency period 18-23 March. The Civil Defense cleared their requests through the Office of Emergency Planning and in behalf of 30 separate cities and towns in Massachusetts. The sandbags were transported and temporarily stored by the Massachusetts Department of Public Works at its Wellesley depot. The sandbags were provided and accepted with the clear understanding that they would be returned or that the Corps would be reimbursed for their cost. A tabulation of the

widespread use of the sandbags by the various towns follows:

Andover	200	Lowell	2,000
Ashland	600	Maynard	1,600
Attleboro	1,000	Natick	2,000
Bedford	10,000	Needham	6,000
Beverly	1,000	Newton	6,000
Billerica	6,400	Saugus	1,000
Boston	2,400	Stowe	200
Canton	1,000	Sudbury	150
Dedham	6,000	Taunton	2,600
Dover	2,000	Tewksbury	3,200
Easton	600	Waltham	6,000
Framingham	1,000	Watertown	8,000
Freetown	600	Wayland	10,000
Hamilton	200	Wellesley	4,000
Ipswich	1,000	Westford	600

9. HEADQUARTERS OPERATION DURING FLOOD EMERGENCY

Owing to the wide extent of the flood emergency that began to develop on 19 March, a total of 8 teams of engineers were dispatched from Headquarters to specific locations where reports indicated emergency conditions might exist. These teams were sent out primarily as observers. As trouble spots developed teams were dispatched on 20, 21 and 22 March for the purpose of having Corps representation in the field. The number of teams in the field varied from 4 to 8 at any one time. Over the week-end of 22-25 March an around-the-clock telephone watch was maintained to monitor incoming telephone calls. This was in addition to the overtime Headquarters staff (Reservoir Regulation Section) which was on hand during the normal work week of 19-23 March.

Subsequent to the flood period a total of ten 2-man parties were sent out to mark and record high watermarks. This was accomplished over a

10-day period. Actual leveling in of the marks will be accomplished as funds become available.

10. GENERAL SUMMARY

The emergency operations aspect of the flooding of March 1968 continually bordered on, but never actually crossed over into that stage where the Corps would take actual control of flood fighting activities.

PART V - FLOOD PROFILES

(To be submitted at a later date)

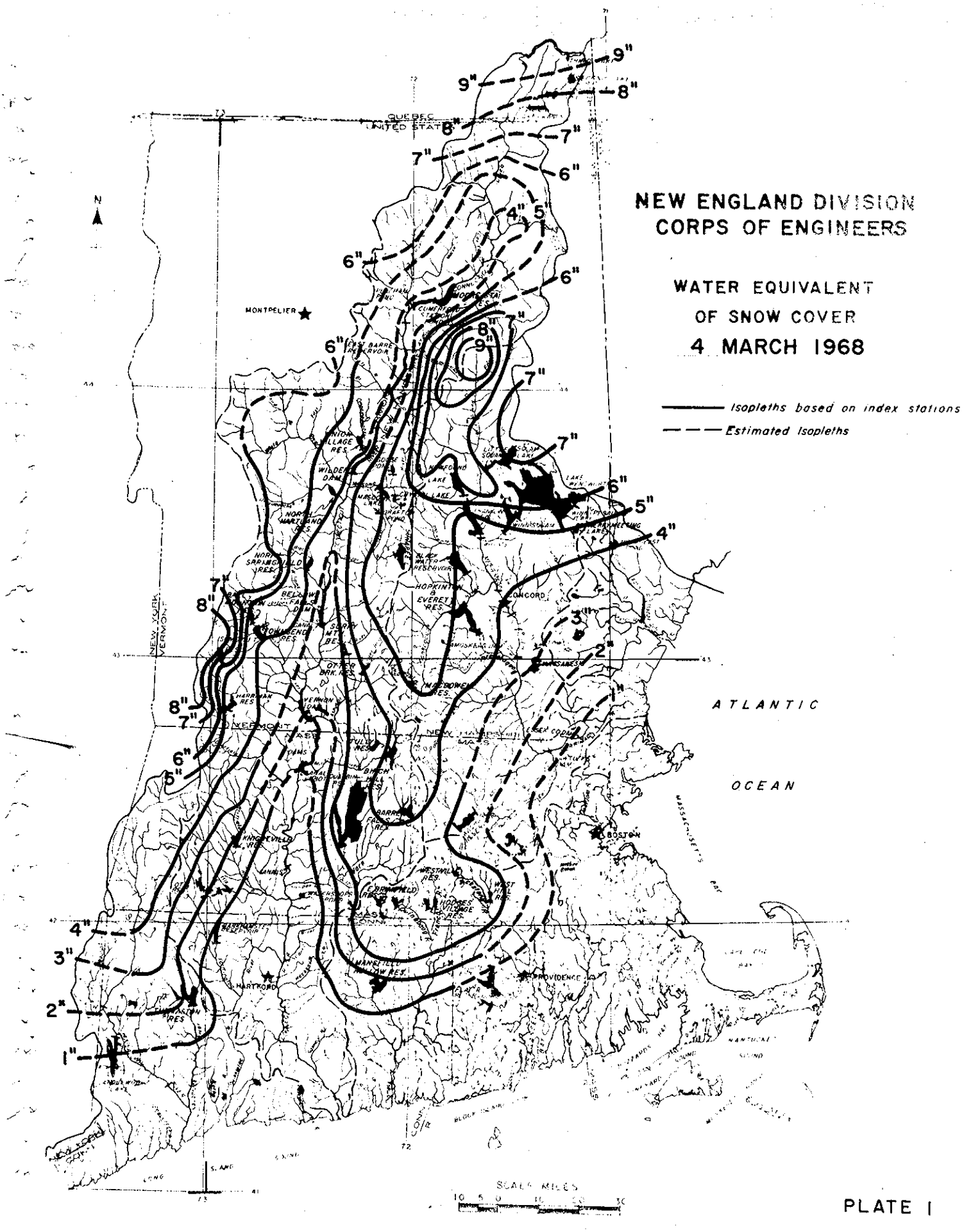

NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WATER EQUIVALENT
OF SNOW COVER
4 MARCH 1968
Isopleths based on index stations
Estimated Isopleths
ATLANTIC
OCEAN
MONTPELIER
BOSTON
HARTFORD
PROVIDENCE
CONCORD
QUEBEC
UNITED STATES
NEW YORK
VERMONT
MASS.
SCALE MILES
9"
8"
7"
6"
5"
4"
3"
2"
1"

PLATE I

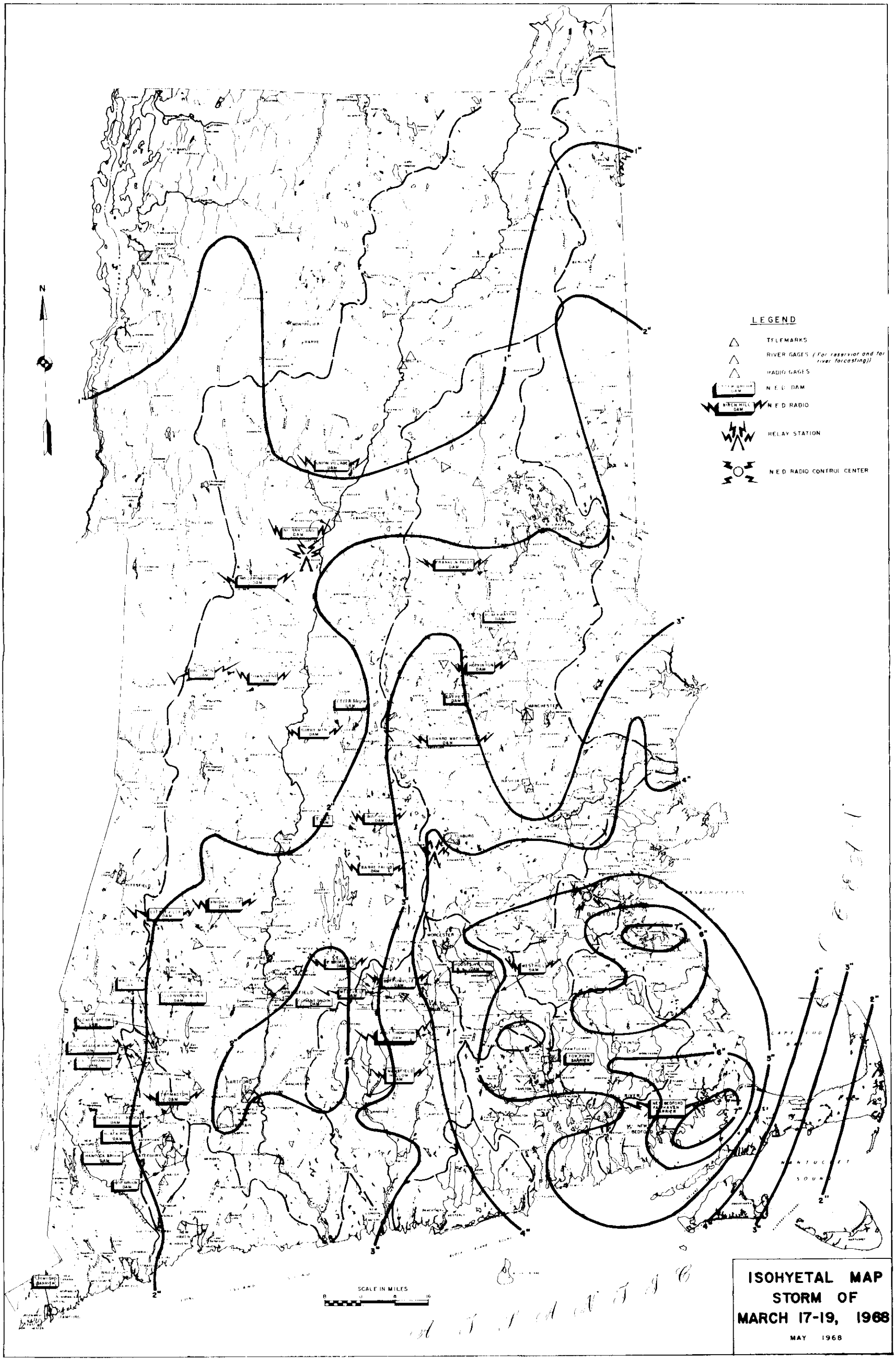
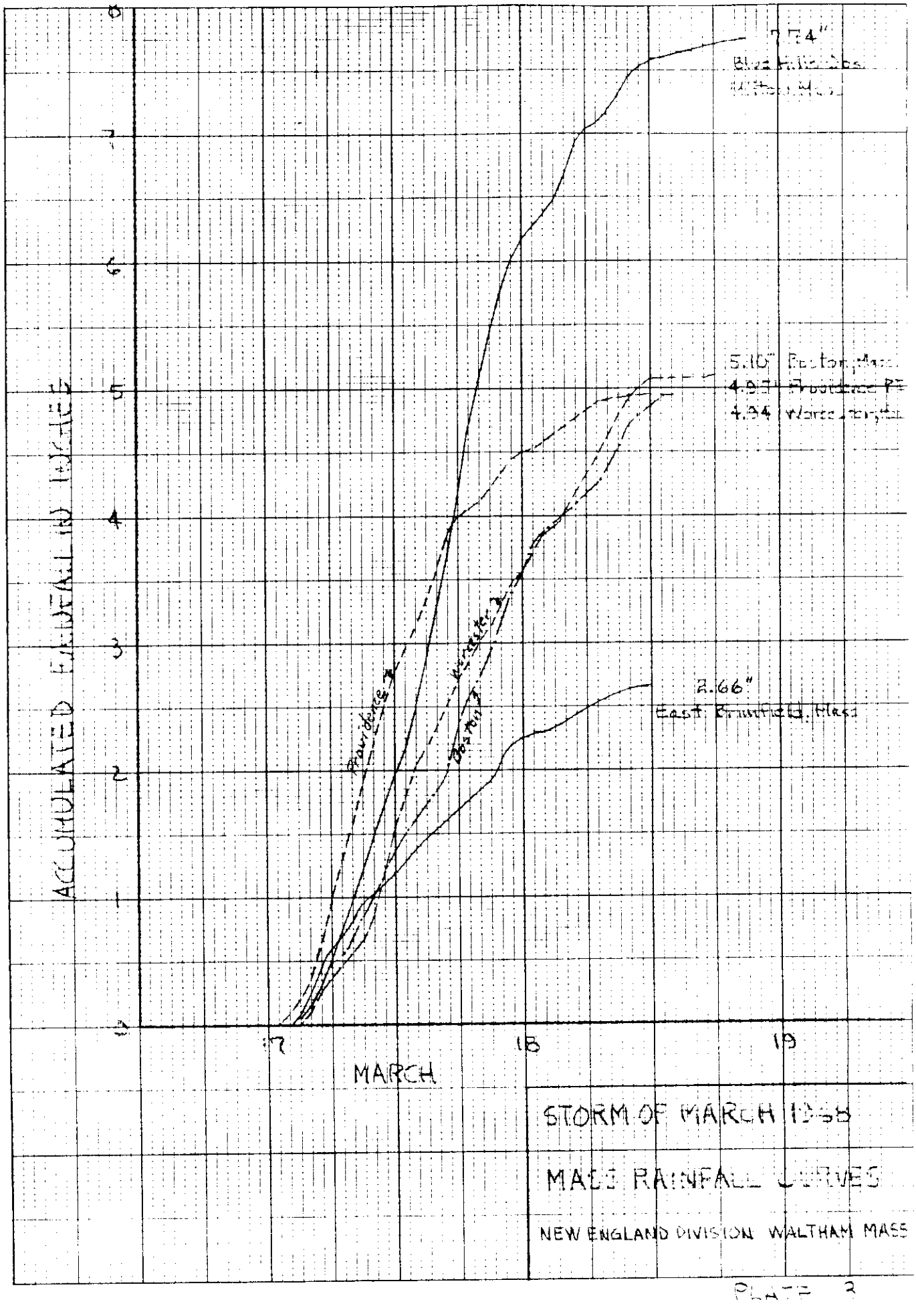

N
LEGEND
TELEMARKS
RIVER GAGES (For reservior and for river forcasting))
RADIO GAGES
N.E.D. DAM
N.E.D. RADIO
RELAY STATION
N.E.D. RADIO CONTROL CENTER
SCALE IN MILES
ISOHYETAL MAP
STORM OF
MARCH 17-19, 1968
MAY 1968

PLATE 2



STORM OF MARCH 1936

MEAN RAINFALL CURVES

NEW ENGLAND DIVISION WALTHAM MASS

PLATE 2

WEST THOMPSON
(173.5 Sq Mi (Total))
(148 Sq Mi (Net))

6000 c.f.s.

Regulated Outflow

WESTMILLE
(99.5 Sq Mi (Total))
(82.05 Sq Mi (Net))

8200 c.f.s.

Regulated Outflow

EAST BRIMFIELD
(67.5 Sq Mi.)

2700 c.f.s.

Regulated Outflow

HODGES VILLAGE
(31.1 Sq Mi.)

2000 c.f.s.

Regulated Outflow

BUFFUMVILLE
(26.5 Sq Mi.)

1600 c.f.s.

Regulated Outflow

MANSFIELD HOLLOW
(159 Sq Mi.)

6000 c.f.s.

Regulated Outflow

DISCHARGE IN 1000 C.F.S.

MARCH

FLOOD OF MARCH 1968
THAMES RIVER BASIN
RESERVOIR REGULATION
NEW ENGLAND DIVISION WALTHAM, MASS.

PLATE 4

American Optical Dam
Quinebaug R. at Southbridge, Mass
(126 Sq. Mi. (Total))
(117.5 Sq. Mi. (Net))

4500 c.f.s.
COMPUTED NATURAL DISCHARGE
1500 c.f.s.
OBSERVED DISCHARGE

U.S.G.S. Gaging Station
French R. at Webster, Mass
(35.5 Sq. Mi. (Total))
(27.7 Sq. Mi. (Net))

3850 c.f.s.
COMPUTED NATURAL DISCHARGE
1050 c.f.s.
OBSERVED DISCHARGE

U.S.G.S. Gaging Station
Quinebaug R. at Putnam, Conn.
(351 Sq. mi. (Total))
(100 Sq. mi. (Net))

11,200 c.f.s.
COMPUTED NATURAL DISCHARGE
3800 c.f.s.
OBSERVED DISCHARGE

U.S.G.S. Gaging Station
Shetucket R. at Willimantic, Conn.
(401 Sq. Mi. (Total))
(342 Sq. Mi. (Net))

10,000 c.f.s.
COMPUTED NATURAL DISCHARGE
4500 c.f.s.
DISCHARGE
OBSERVED

DISCHARGE IN 1000 C.F.S.

MARCH

FLOOD OF MARCH 1936
THAMES RIVER BASIN
EFFECT OF RESERVOIR REGULATION AT INDEX STATIONS
NEW ENGLAND DIVISION WALTHAM, MASS.

PLATE 5

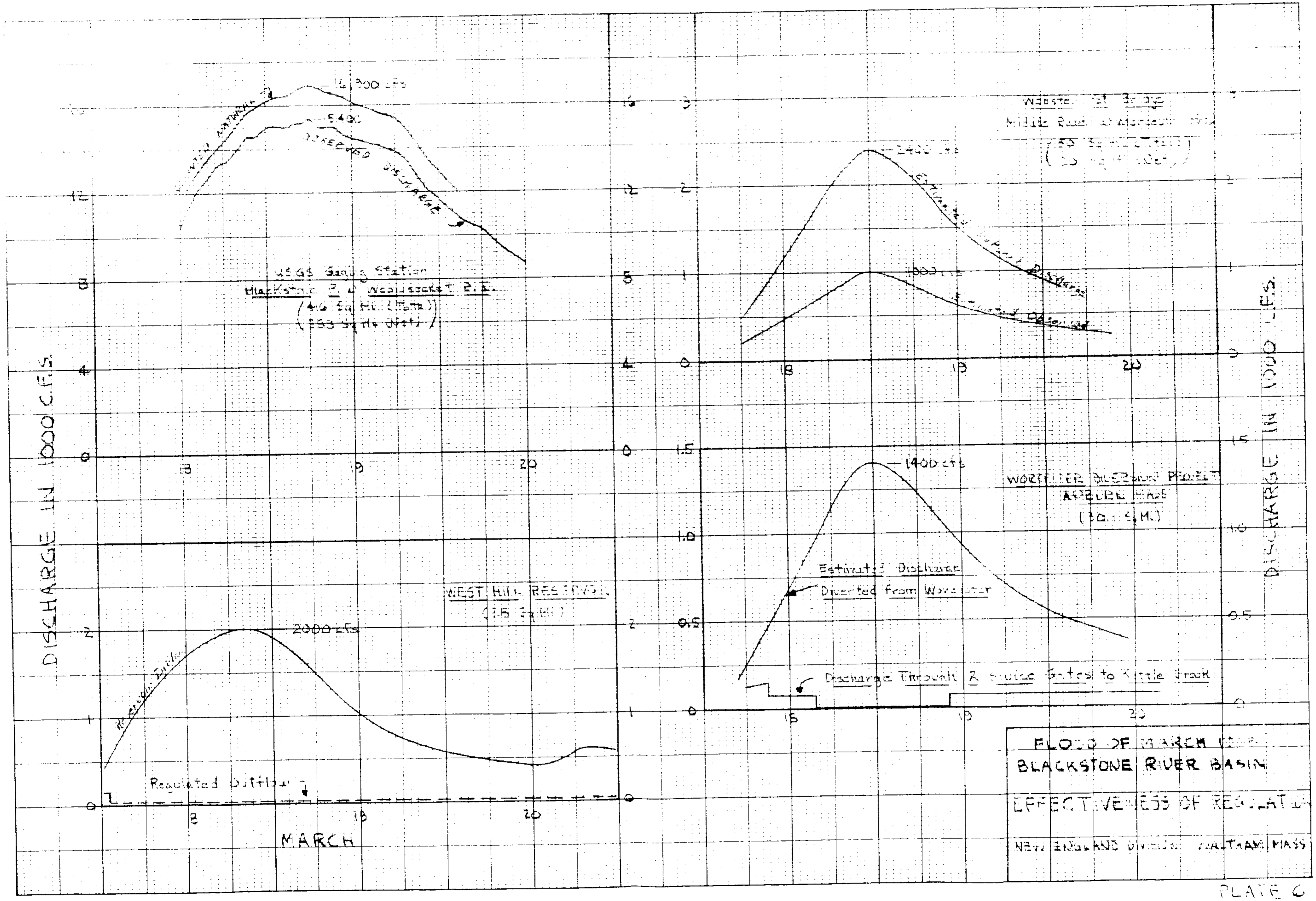
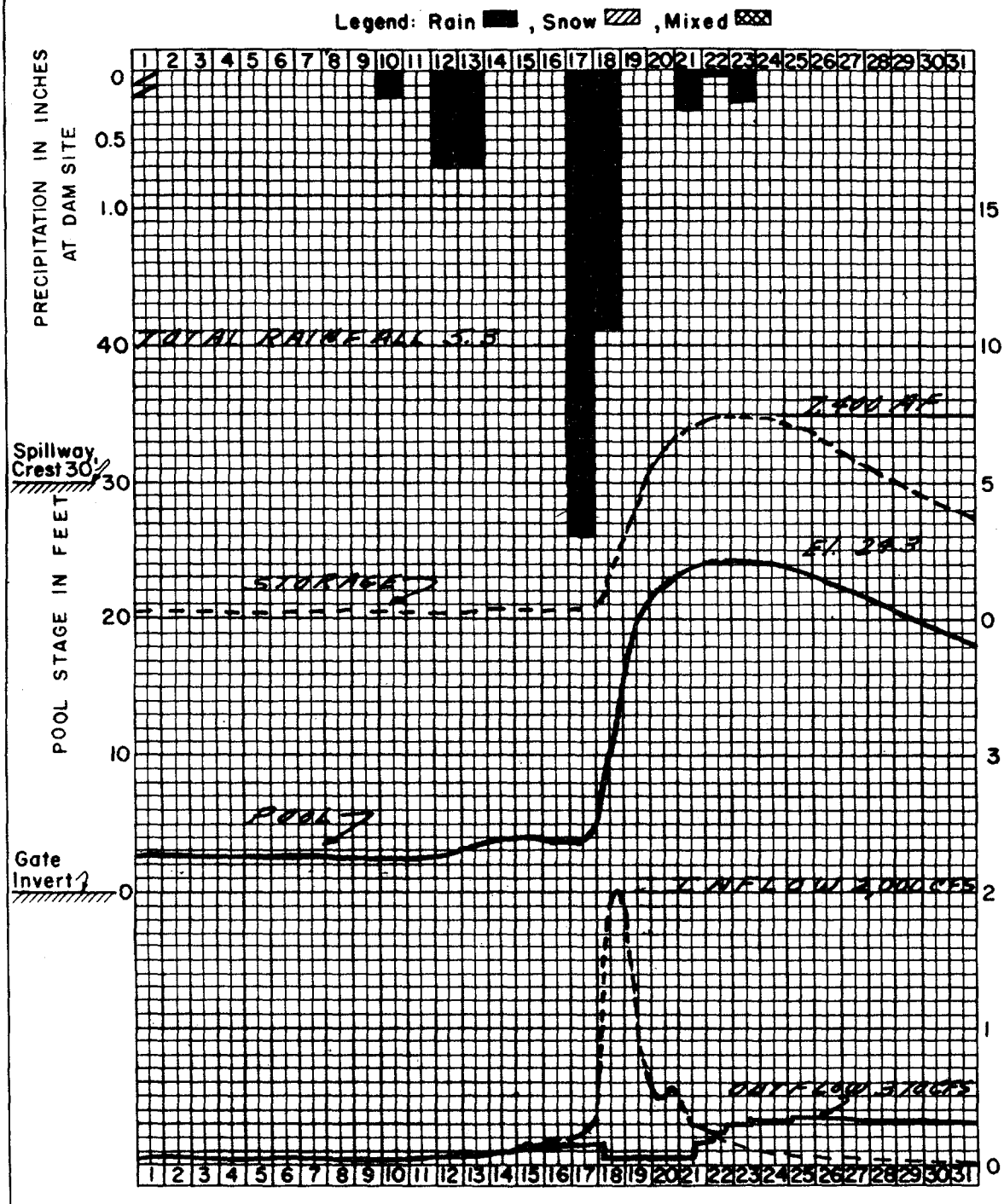

DISCHARGE IN 1000 C.F.S.
U.S.G.S. Gaging Station
16,300 cfs
5400
2400 cfs
1000 cfs
1400 cfs
Estimated Discharge
Diverted from Worcester
WEST HILL RESERVOIR
2000 cfs
Regulated Outflow
Discharge Through 2 Sluice Gates to Kettle Brook
MARCH
BLACKSTONE RIVER BASIN
WALTHAM MASS

PLATE 6



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

WEST HILL RESERVOIR
BLACKSTONE RIVER BASIN
D.A. = 28 SQ. MILES

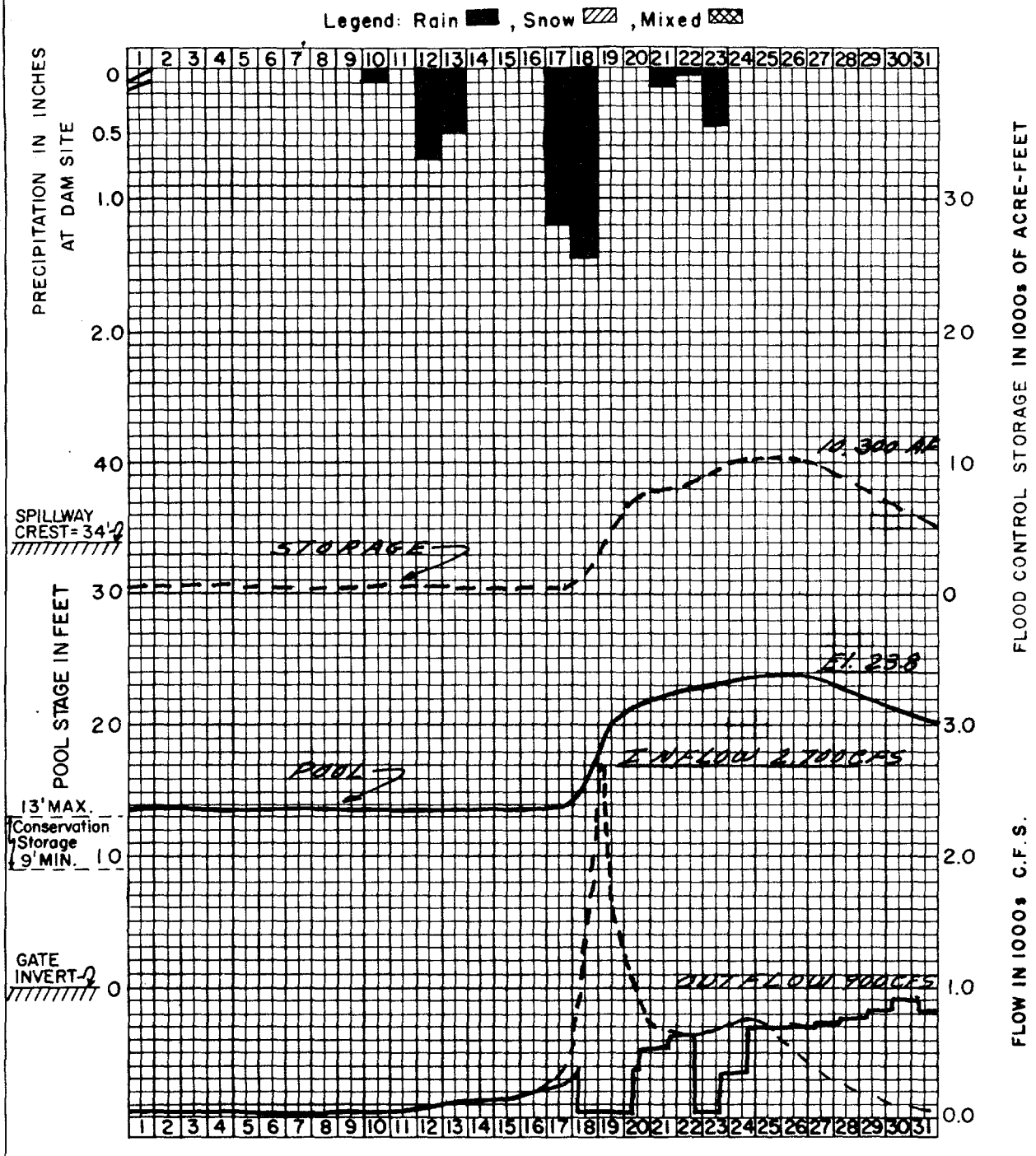
	ELEVATION M.S.L.	STAGE FEET	NET STORAGE AC-FT
Gate Invert	234.0	0	0
Permanent Pool	None	—	—
Spillway Crest	264.0	30.0	12,440

Outlet Capacity at Full Pool = 1,480 c.f.s.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 7

U.S. ARMY



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

EAST BRIMFIELD RESERVOIR
THAMES RIVER BASIN
QUINEBAUG RIVER, MASS.
D.A. = 67.5 SQ. MILES

	ELEVATION (M.S.L.)	STAGE (FEET)	GROSS STORAGE (AC-FT)
Gate Invert	619	0	0
Conservation Pool (Min.)	628	9	700
Conservation Pool (Max.)	632	13	1,900
Spillway Crest	653	34	31,800

Outlet Capacity at Full Pool = 3,300 C.F.S.

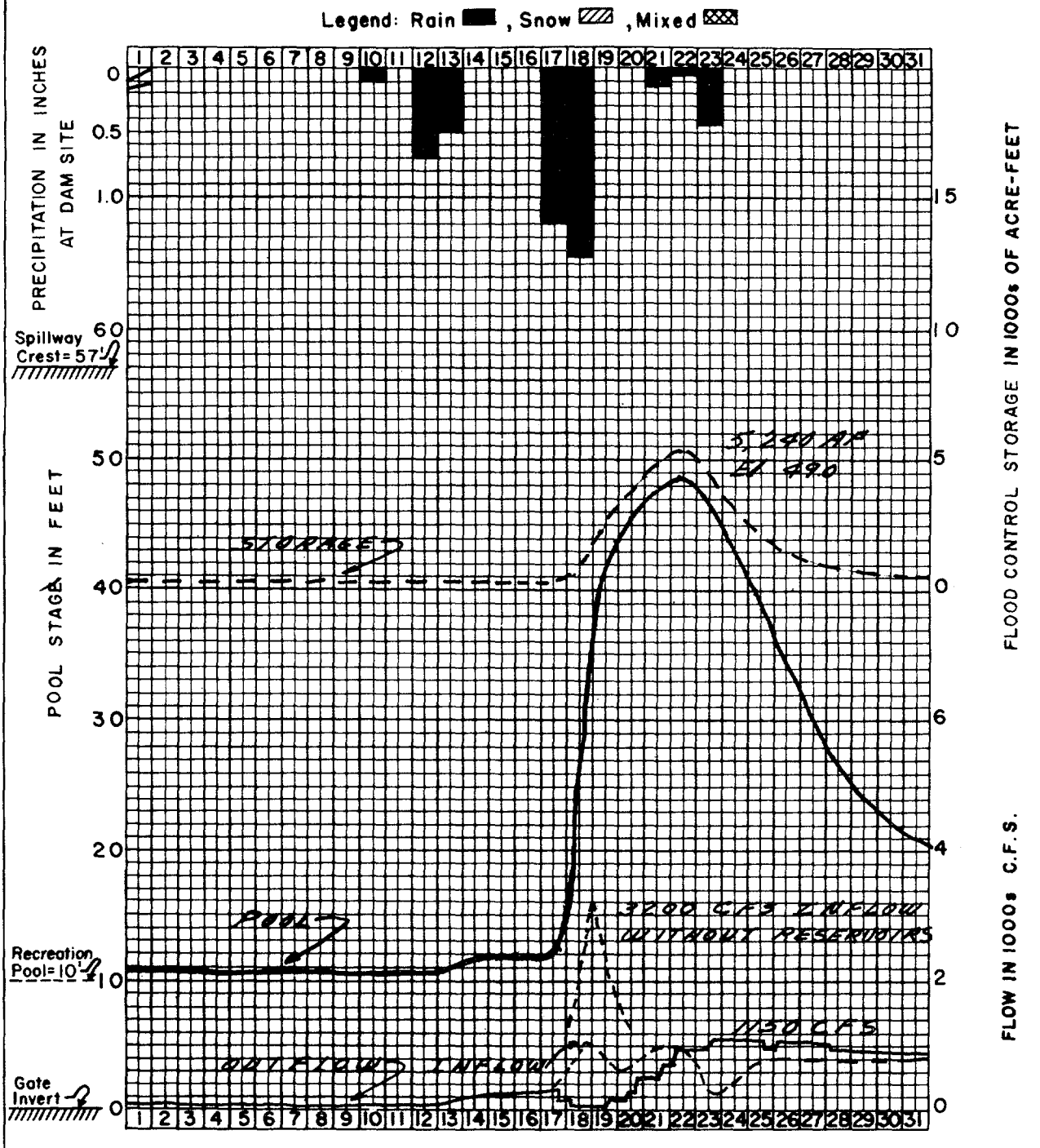
NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 8

U.S. ARMY

CORPS OF ENGINEERS

Reports Control Symbol ENGCW-E-6



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

WESTVILLE RESERVOIR

THAMES RIVER BASIN

QUINEBAUG RIVER, MASSACHUSETTS

D.A. = (Net) 32.0 SQ. MILES
(Gross) 99.5 SQ. MILES

	ELEVATION (M.S.L.)	STAGE (FEET)	GROSS STORAGE (AC-FT)
Gate Invert	515	0	0
Recreation Pool	525	10	100
Spillway Crest	572	57	11,100

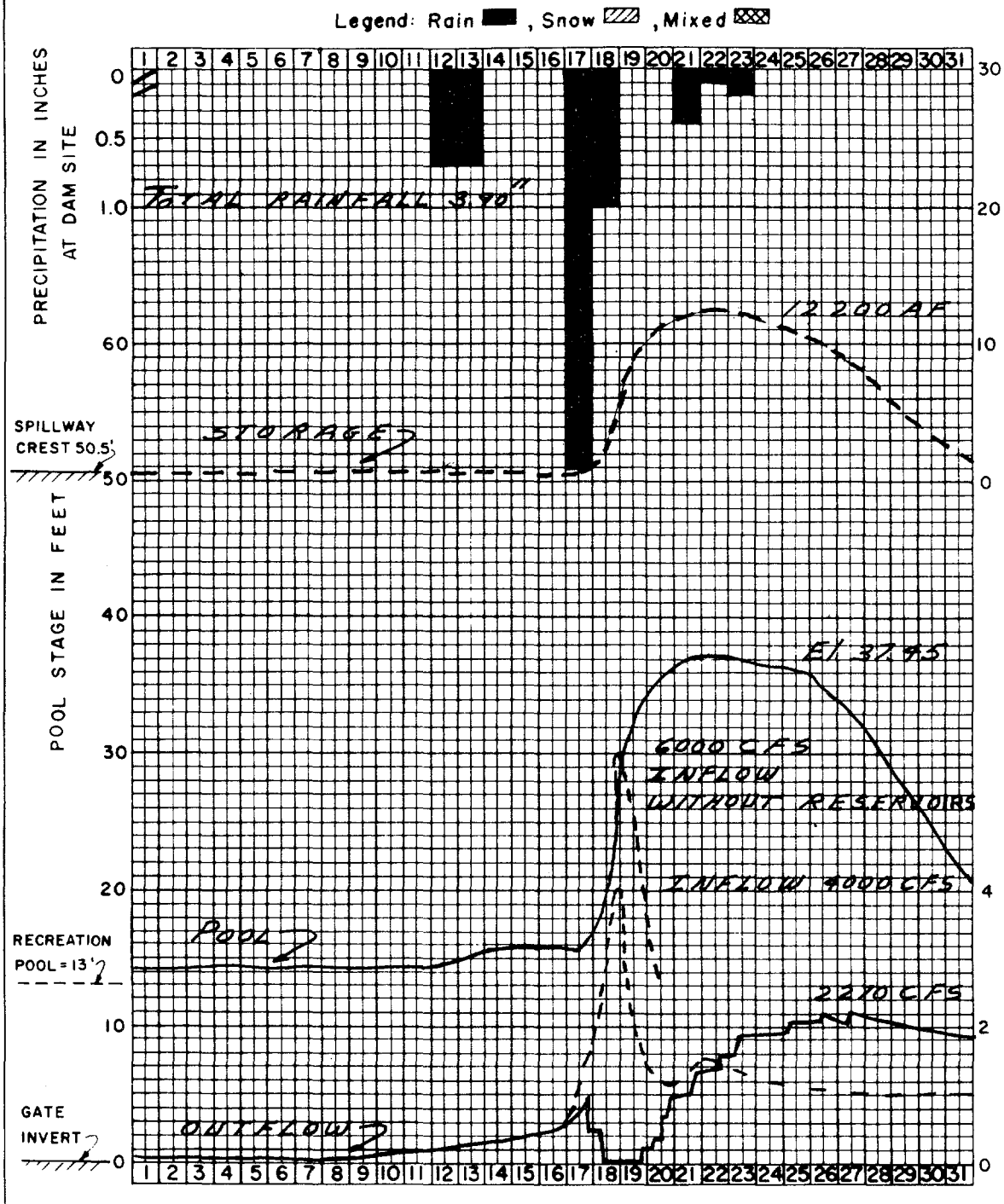
Outlet Capacity at Full Pool = 3,750 C.F.S.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 9

U.S. ARMY CORPS OF ENGINEERS

Reports Control Symbol ENGCW-E-6



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

WEST THOMPSON RESERVOIR

THAMES RIVER BASIN

D.A. = (Net) 74 Sq. Miles
(Gross) 174 Sq. Miles

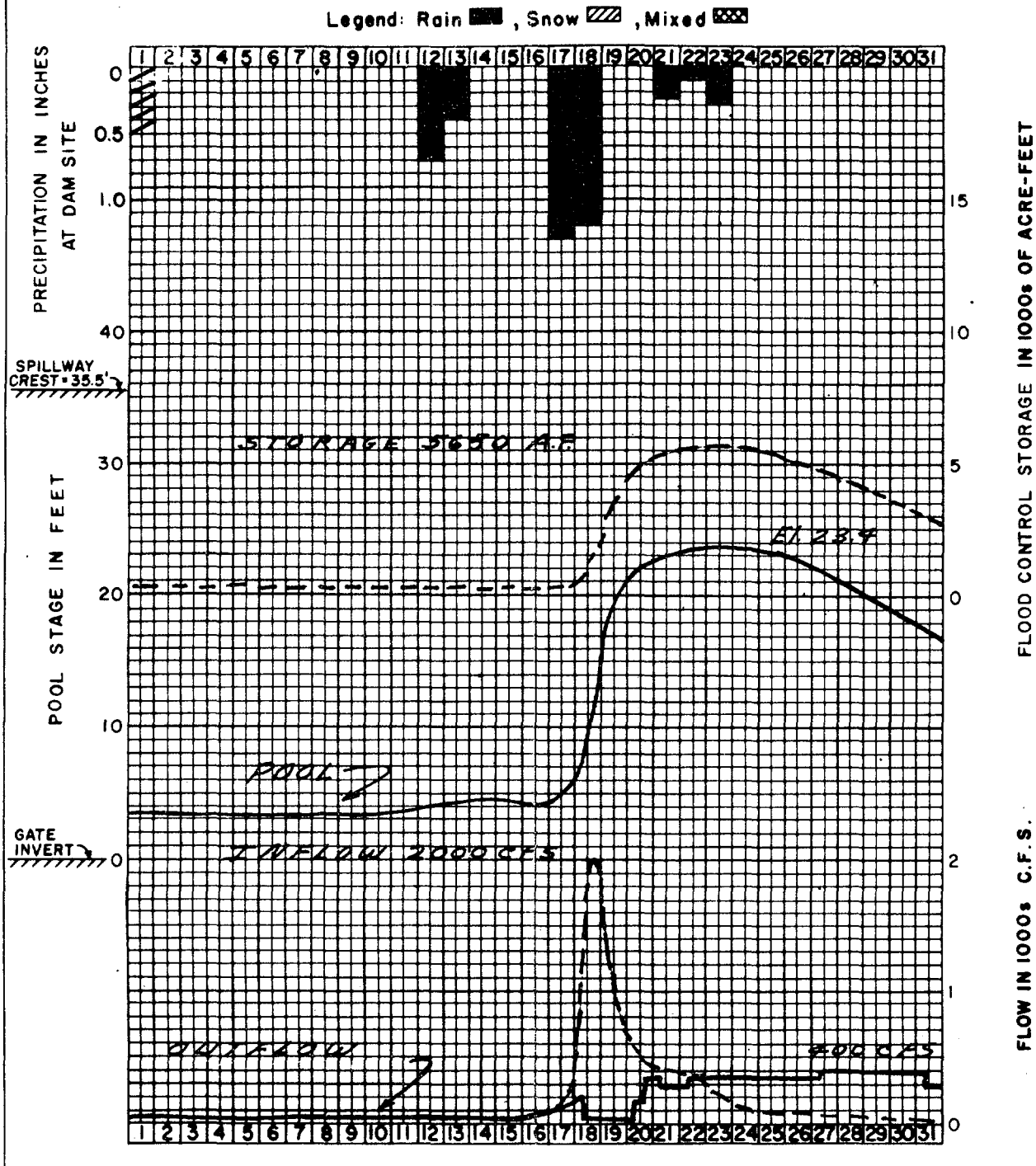
	ELEVATION M.S.L.	STAGE FEET	NET STORAGE AC-FT
Gate Invert	292	0	0
Recreation Pool	305	13	1,200
Spillway Crest	342.5	50.5	25,600

Outlet Capacity at Full Pool = 5,100 C.F.S.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 10

Reports Control Symbol ENGCW-E-6



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

HODGES VILLAGE RESERVOIR
THAMES RIVER BASIN
D.A. = 31.1 SQ. MILES

	ELEVATION M.S.L.	STAGE FEET	NET STORAGE AC-FT
Gate Invert	465.5	0	0
Permanent Pool	NONE	—	—
Spillway Crest	501.0	35.5	13,250

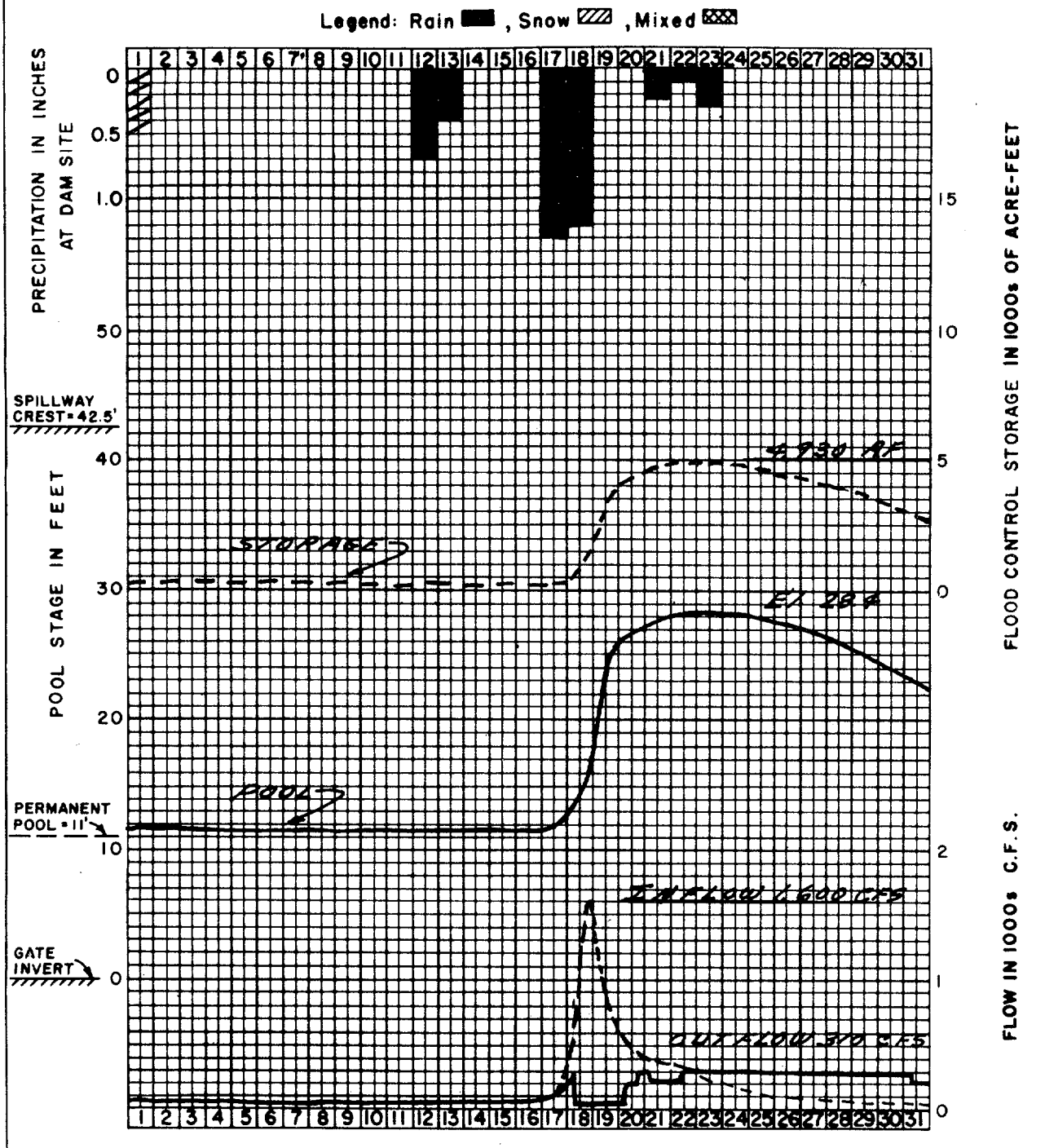
Outlet Capacity at Full Pool = 1750 C.F.S.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 11

U.S. ARMY CORPS OF ENGINEERS

Reports Control Symbol ENGCW-E-6



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

BUFFUMVILLE RESERVOIR

THAMES RIVER BASIN

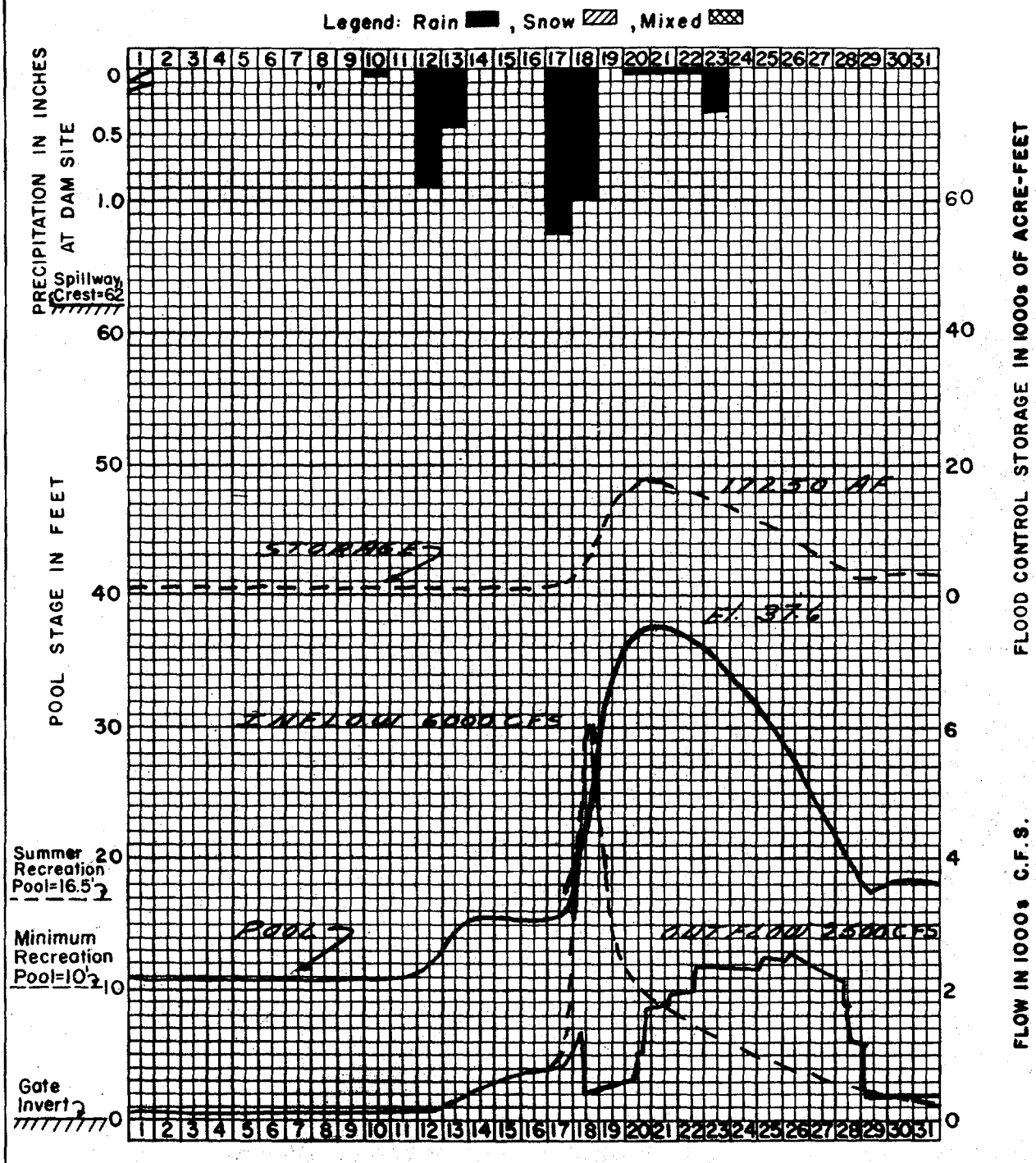
D.A. = 26.5 SQ. MILES

	ELEVATION M.S.L.	STAGE FEET	NET STORAGE AC-FT
Gate Invert	481.5	0	0
Permanent Pool	492.5	11.0	1400
Spillway Crest	524.0	42.5	11,300

Outlet Capacity at Full Pool = 1,800 C.F.S.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 12



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

MANSFIELD HOLLOW RESERVOIR

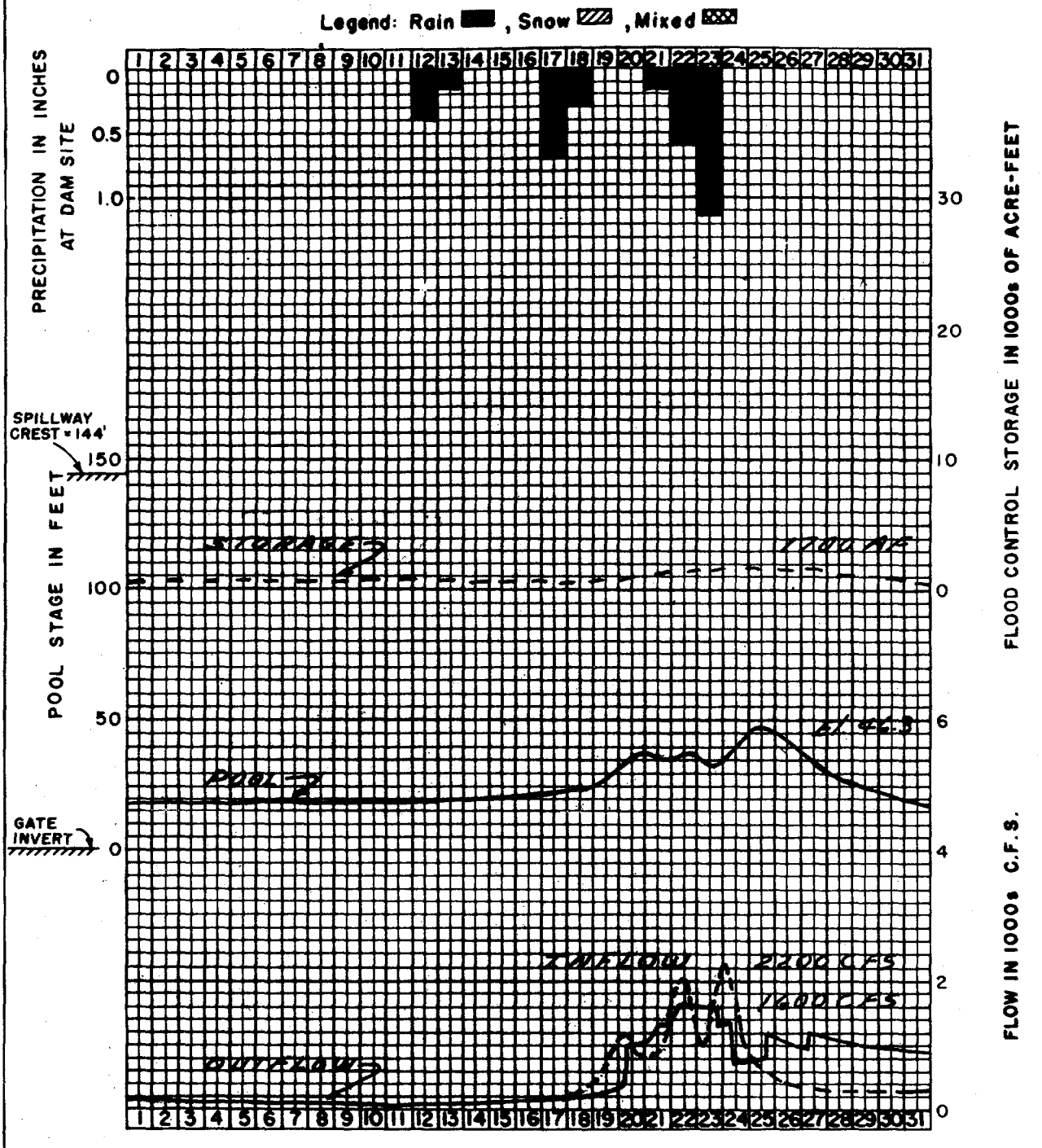
THAMES RIVER BASIN

D.A. = 159 SQ. MILES

	ELEVATION M.S.L.	STAGE FEET	GROSS STORAGE AC-FT
Gate Invert	195.0	0	0
Recreation Pool:			
Minimum	205.0	10.0	580
Summer	211.5	16.5	2,800
Spillway Crest	257.0	62.0	52,000
Outlet Capacity at Full Pool=		10,200	C.F.S.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 13



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

UNION VILLAGE RESERVOIR
CONNECTICUT RIVER BASIN
D.A. = 126 SQ. MILES

NEW ENGLAND DIVISION
WALTHAM, MASS.

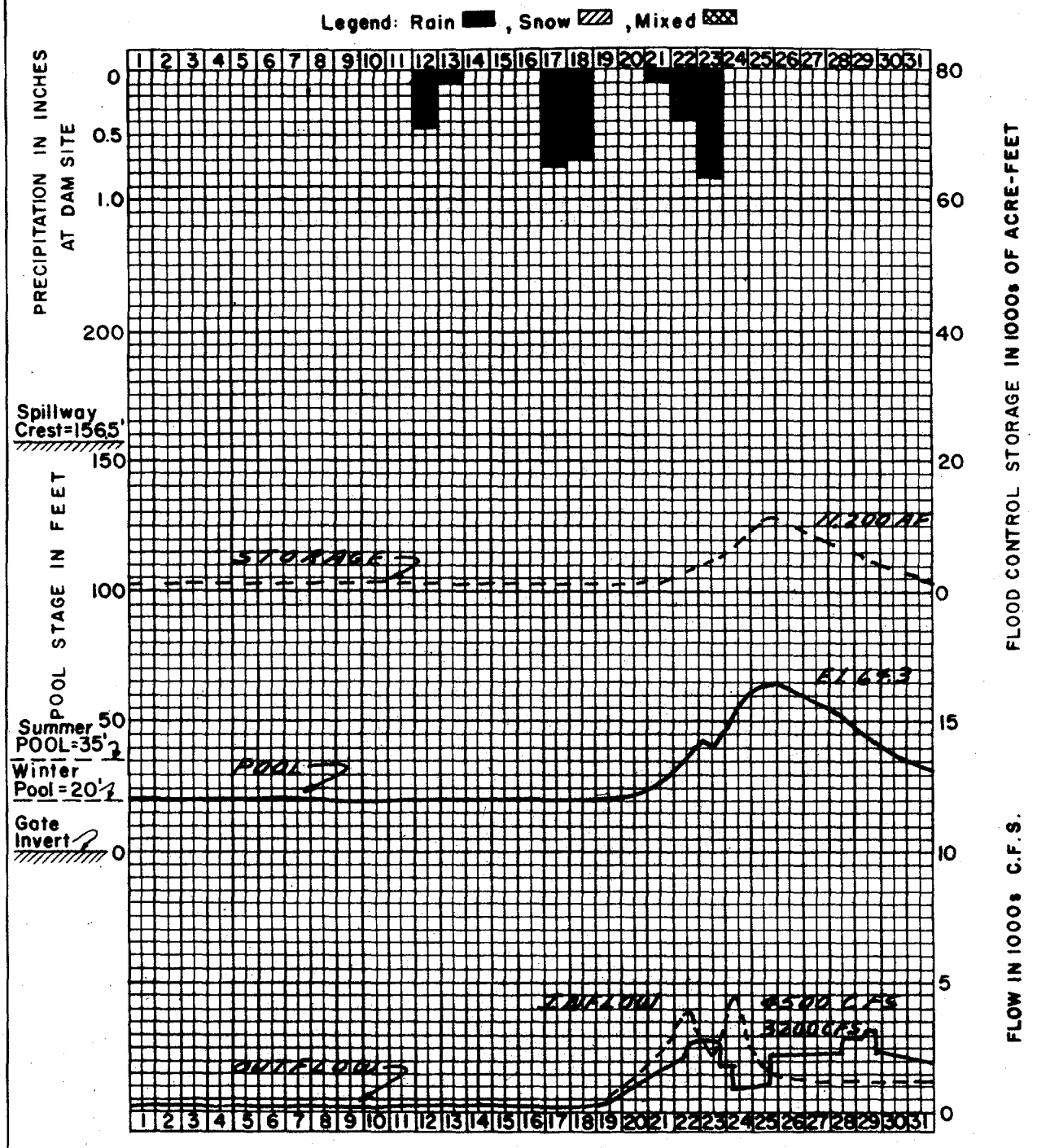
	ELEVATION M.S.L.	STAGE FEET	NET STORAGE AC-FT
Gate Invert	420	0	0
Permanent Pool	NONE	—	—
Spillway Crest	564	144	38,000

*Jet Capacity at Full Pool = 7,800 C.F.S.

PLATE 14

U.S. ARMY

Reports Control Symbol ENGCW E-6



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

NORTH HARTLAND RESERVOIR

OTTAUQUECHEE RIVER BASIN

D.A. = 220 SQ. MILES

	ELEVATION M.S.L.	STAGE FEET	NET STORAGE AC-FT
Gate Invert	390.0	0	0
Winter Pool	410.0	20.0	520
Summer Pool	425.0	35.0	2260
Spillway Crest	546.5	156.5	68,640

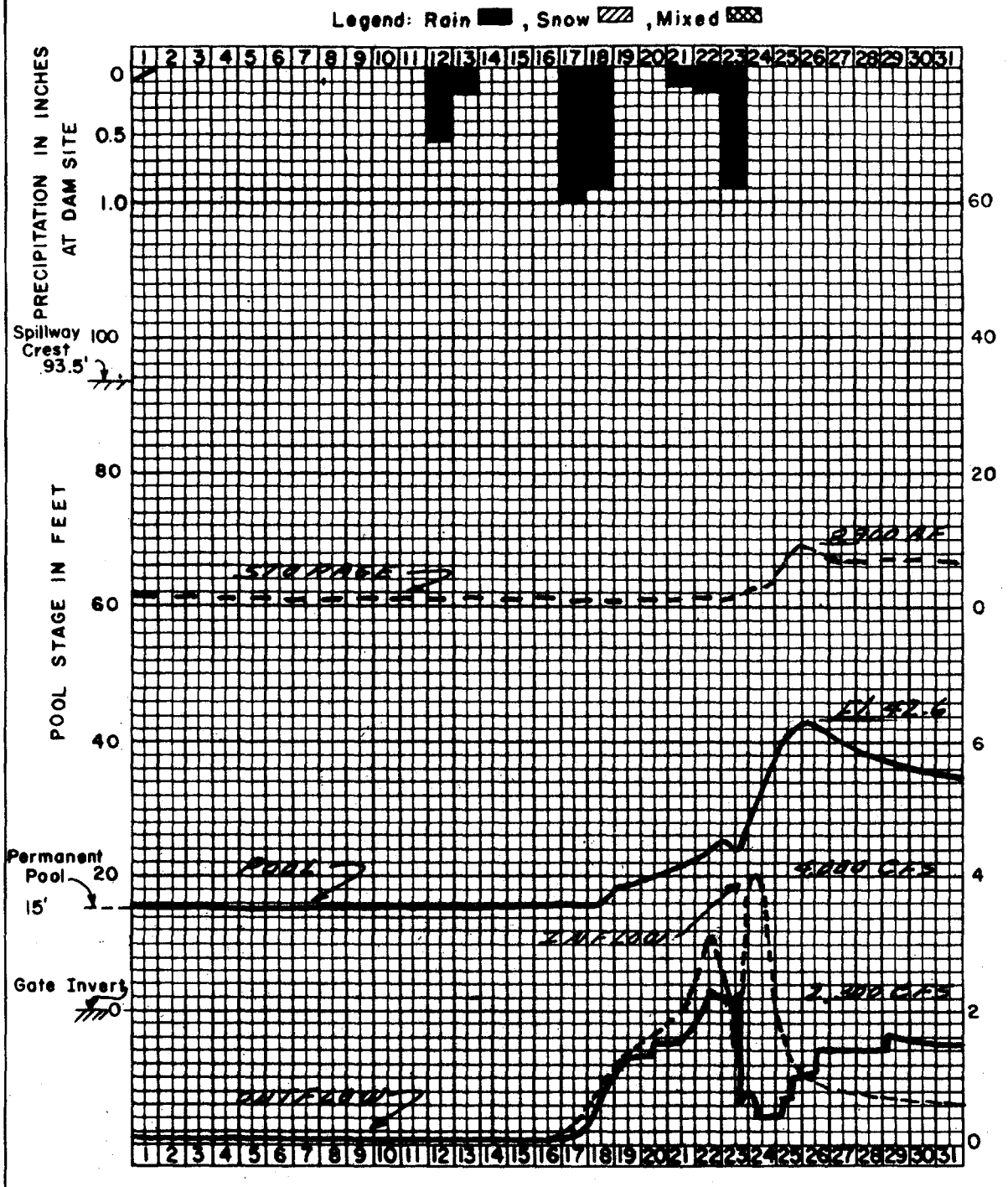
Outlet Capacity at Full Pool = 11,900 c.f.s.

NEW ENGLAND DIVISION

WALTHAM, MASS.

PLATE 15

Control Approval Symbol ENGNV - 1



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

NORTH SPRINGFIELD RESERVOIR

BLACK RIVER BASIN

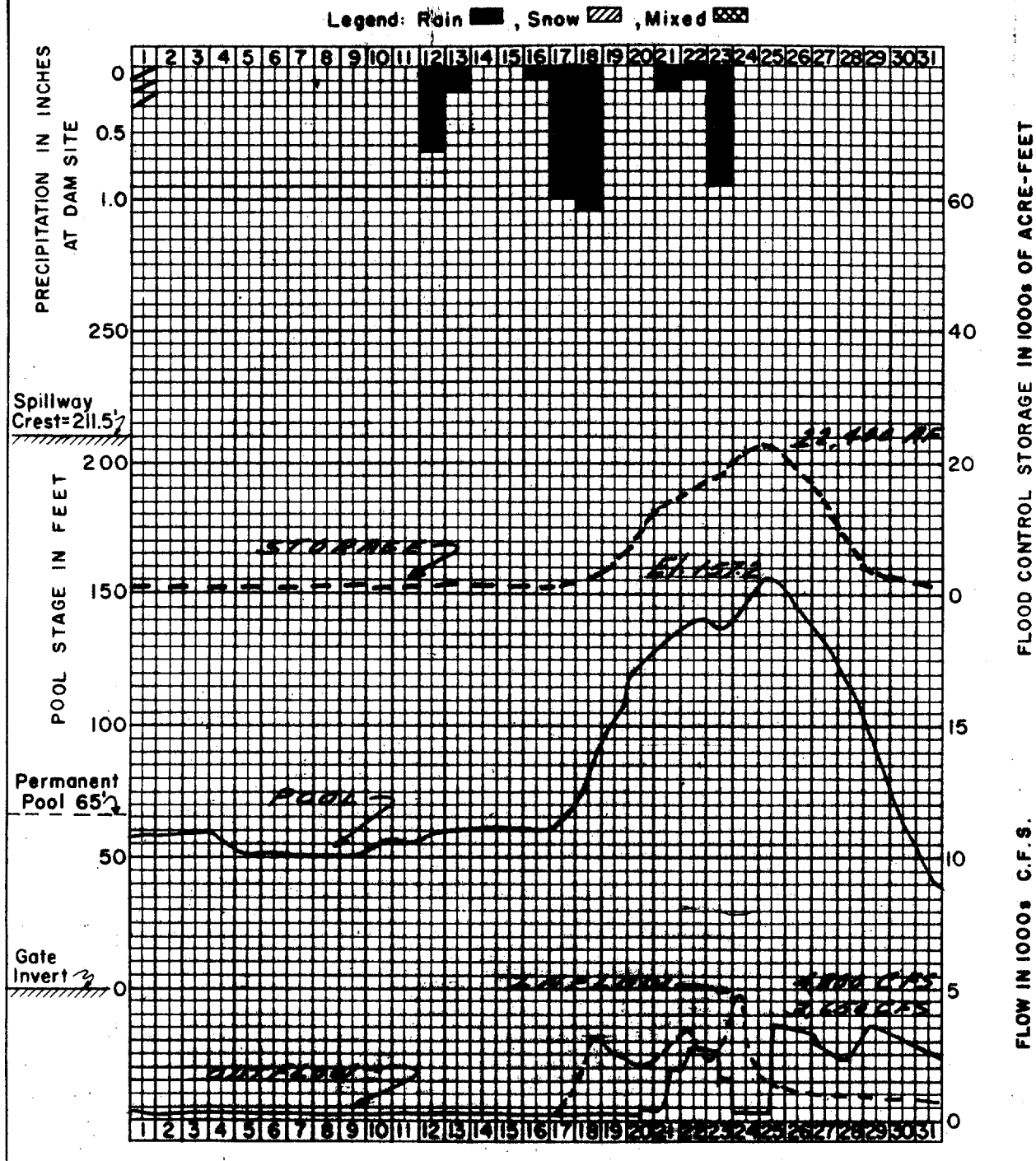
D.A. = 158 SQ. MILES

	ELEVATION M.S.L.	STAGE FEET	NET STORAGE AC-FT
GAte Invert	452.0	0	0
Permanent Pool	467.0	15	500
Spillway Crest	545.5	93.5	50,600

Outlet Capacity at Full Pool = 7650 C.F.S.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 16



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

BALL MOUNTAIN RESERVOIR
WEST RIVER BASIN
D.A. = 172 SQ. MILES

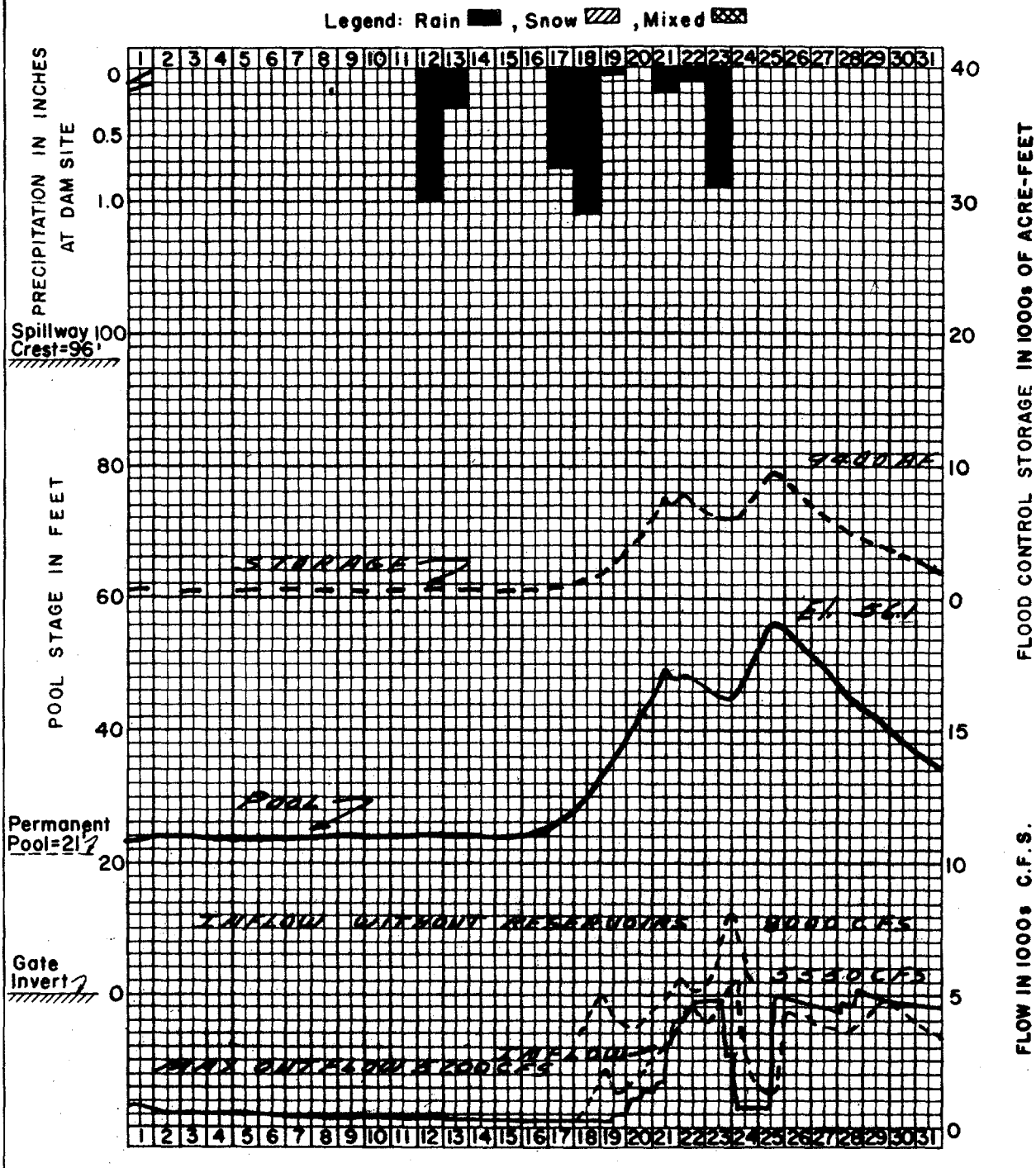
	ELEVATION M.S.L.	STAGE FEET	NET STORAGE AC-FT
Gate Invert	805.5	0	0
Permanent Pool	870.5	65'	2240
Spillway Crest	1017.0	211.5	52,360

Outlet Capacity at Full Pool = 11,350 c.f.s.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 17

Reports Control Symbol ENGCW-E-6



MONTH OF MAR. 1960

MONTHLY RESERVOIR OPERATION

TOWNSHEND RESERVOIR

WEST RIVER BASIN

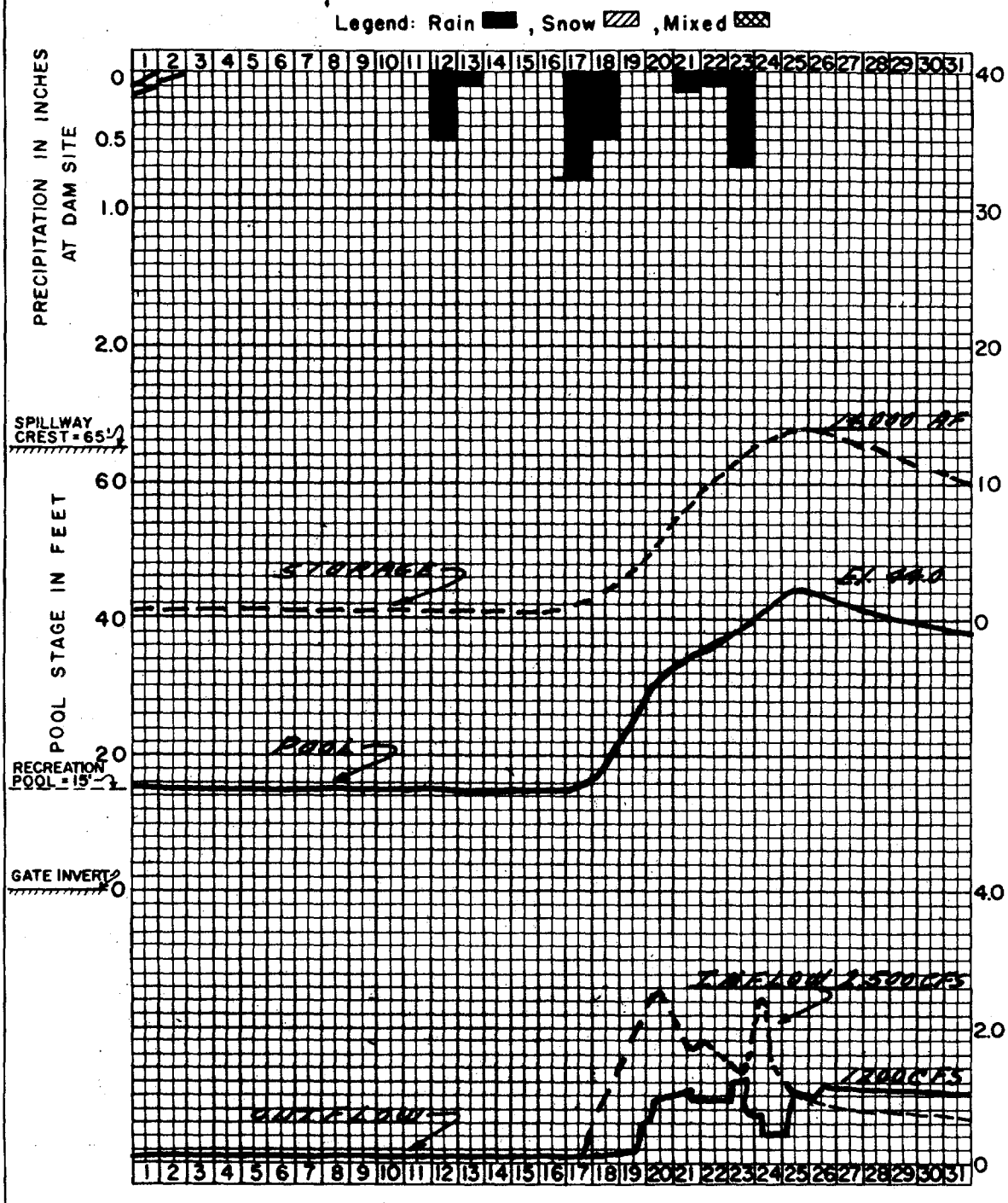
D.A.= (Net.) 106 SQ. MILES
(Gross) 278 " "

	ELEVATION M.S.L.	STAGE FEET	NET STORAGE AC-FT
Gate Invert	457.0	0	0
Permanent Pool	478.0	21.0	800
Spillway Crest	553.0	96.0	32,800

Outlet Capacity at Full Pool = 21,300c.f.s.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 18



MONTH OF MAR 1968

MONTHLY RESERVOIR OPERATION

SURRY MOUNTAIN RESERVOIR
CONNECTICUT RIVER BASIN
ASHUELOT RIVER, N.H.
D.A. = 100 SQ. MILES

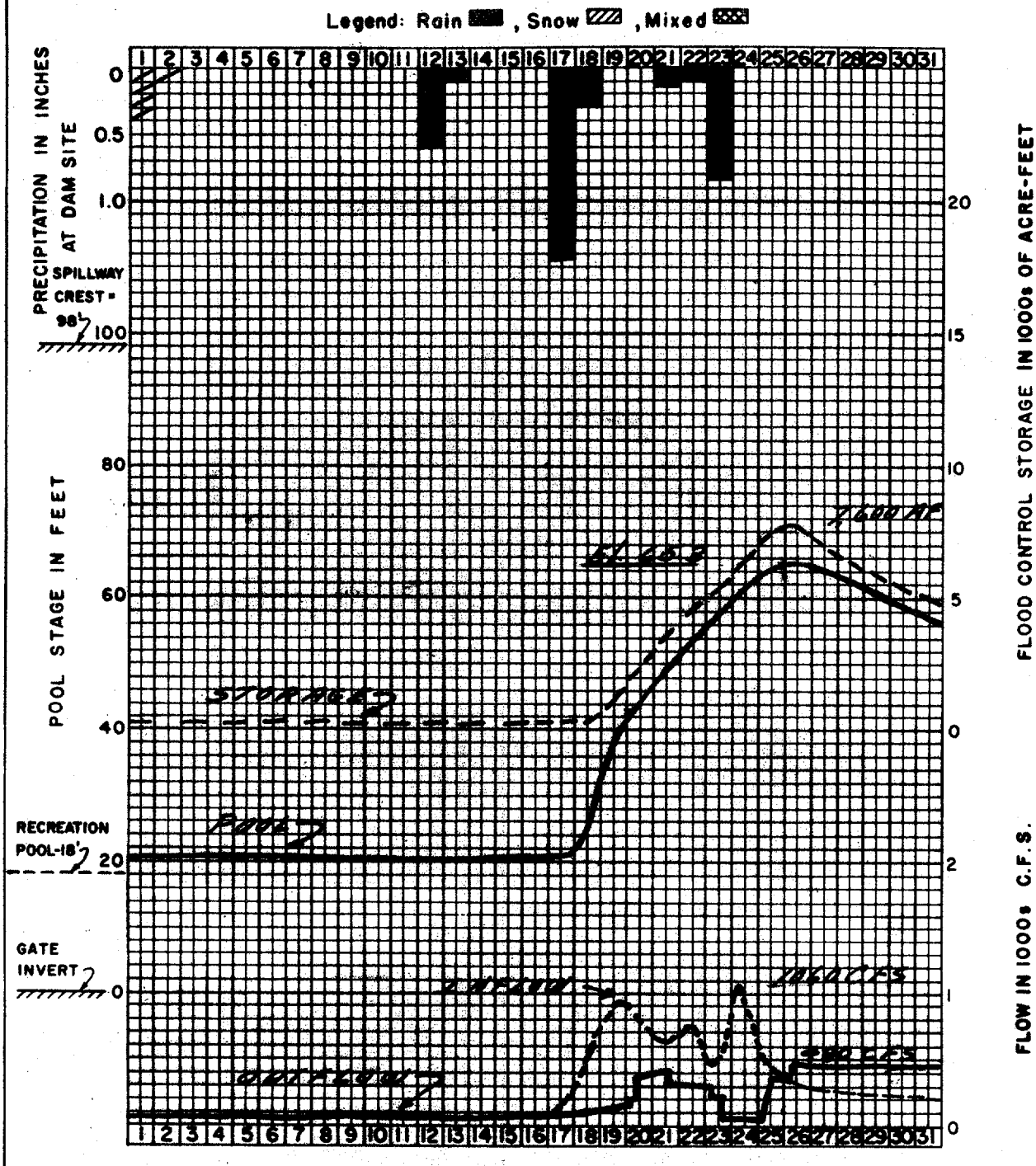
	ELEVATION M.S.L.	STAGE FEET	NET STORAGE AC-FT
Gate Invert	485	0	0
Recreation Pool	500	15	1,320
Spillway Crest	550	65	31,300

Outlet Capacity at Full Pool = 3,660 C.F.S.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 19

Reports Control Symbol ENGCW-E-6



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

OTTER BROOK RESERVOIR

CONNECTICUT RIVER BASIN

D.A. = 47 SQ. MILES

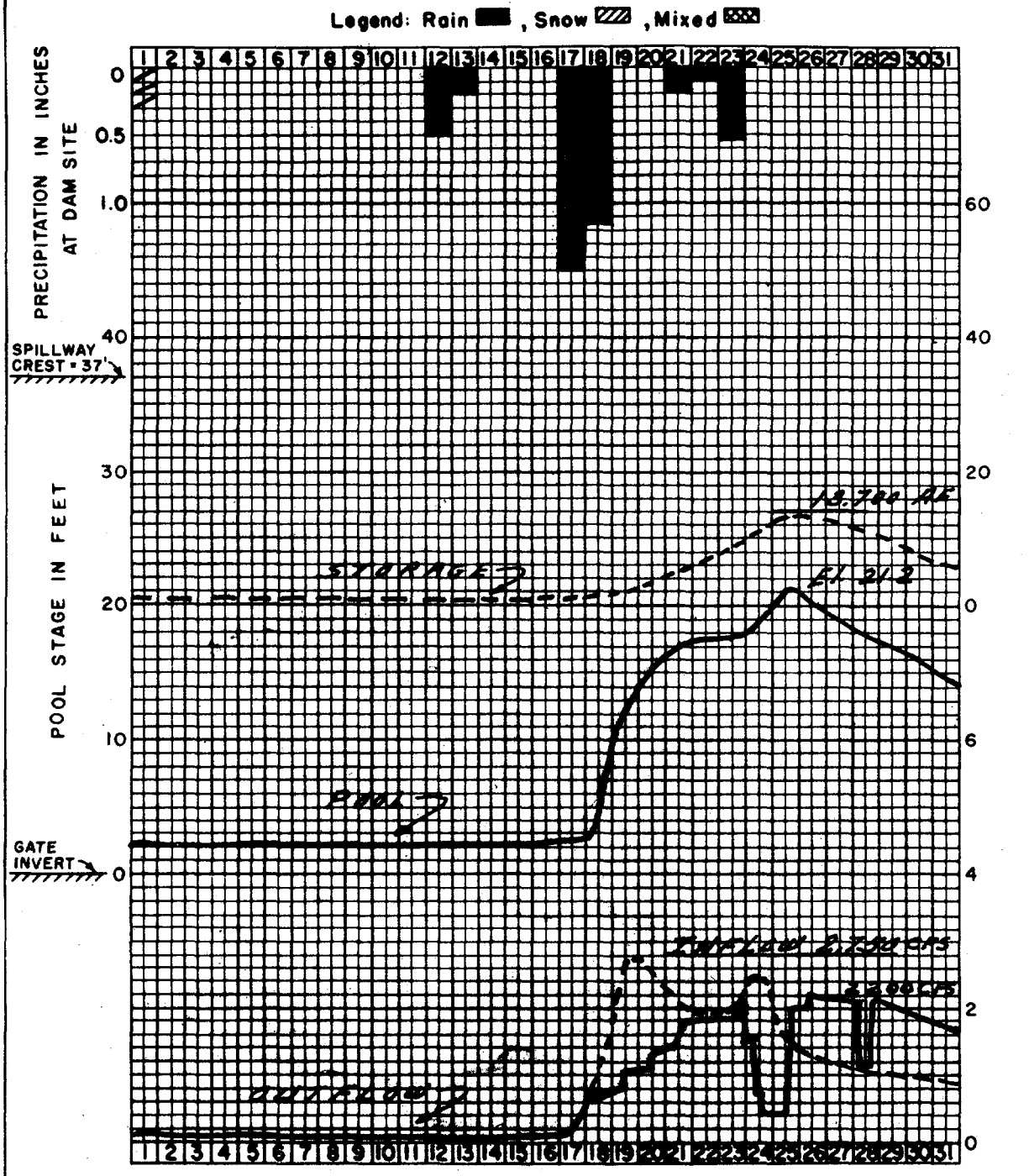
	ELEVATION M.S.L.	STAGE FEET	NET STORAGE AC-FT
Gate Invert	683	0	0
Recreation Pool	701	18	720
Spillway Crest	781	98	17,600

Outlet Capacity at Full Pool = 1,500 C.F.S.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 20

Reports Control Symbol ENGCW-E-6



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

BIRCH HILL RESERVOIR

MILLERS RIVER BASIN

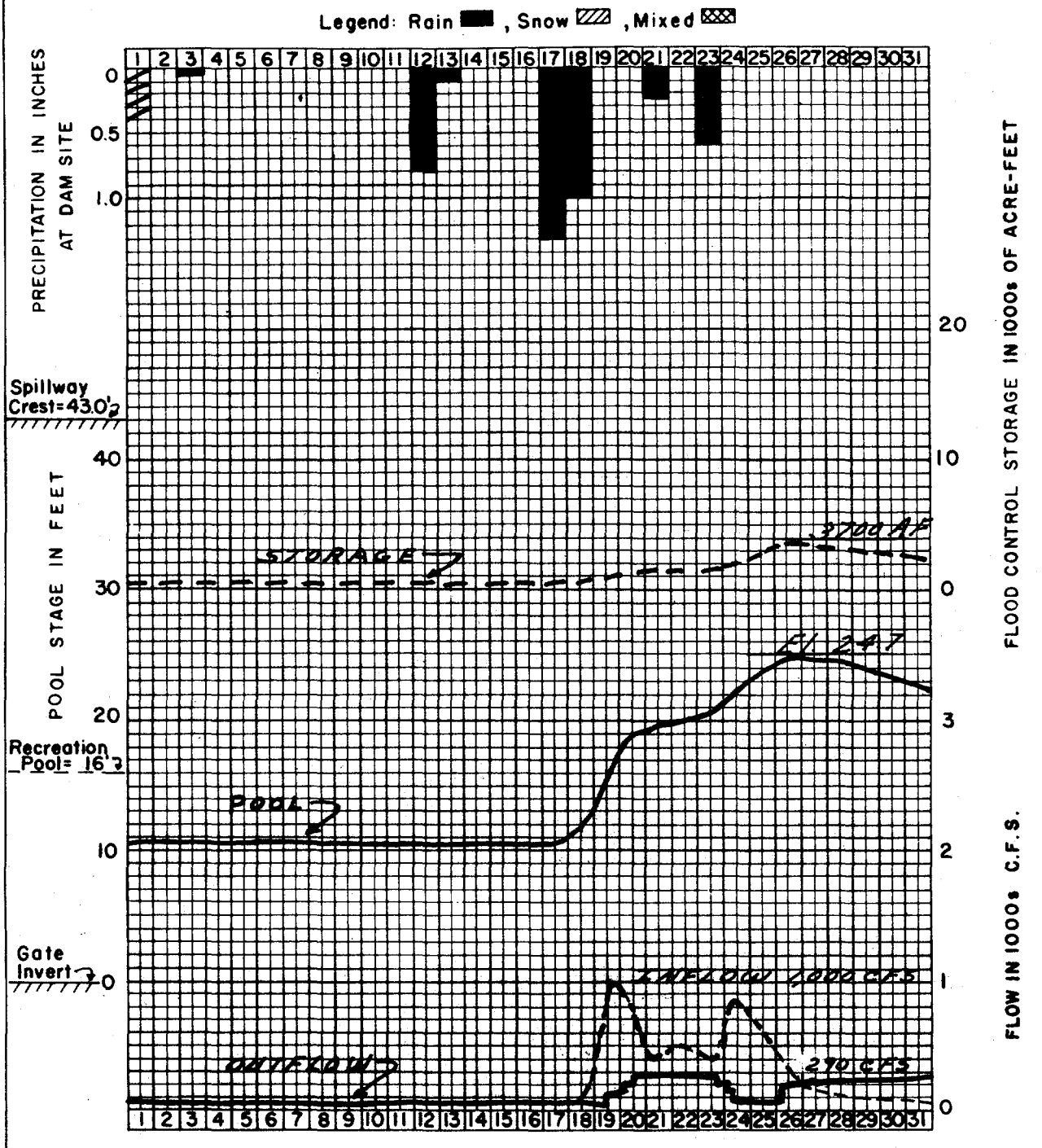
D.A. = 175 SQ. MILES

	ELEVATION M.S.L.	STAGE FEET	NET STORAGE AC-FT
Gate Invert	815	0	0
Permanent Pool	NONE	—	—
Spillway Crest	852	37	49,900

Outlet Capacity at Full Pool = 10,500 C.F.S.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 21



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

TULLY RESERVOIR
MILLERS RIVER BASIN
D.A. = 50 SQ. MILES

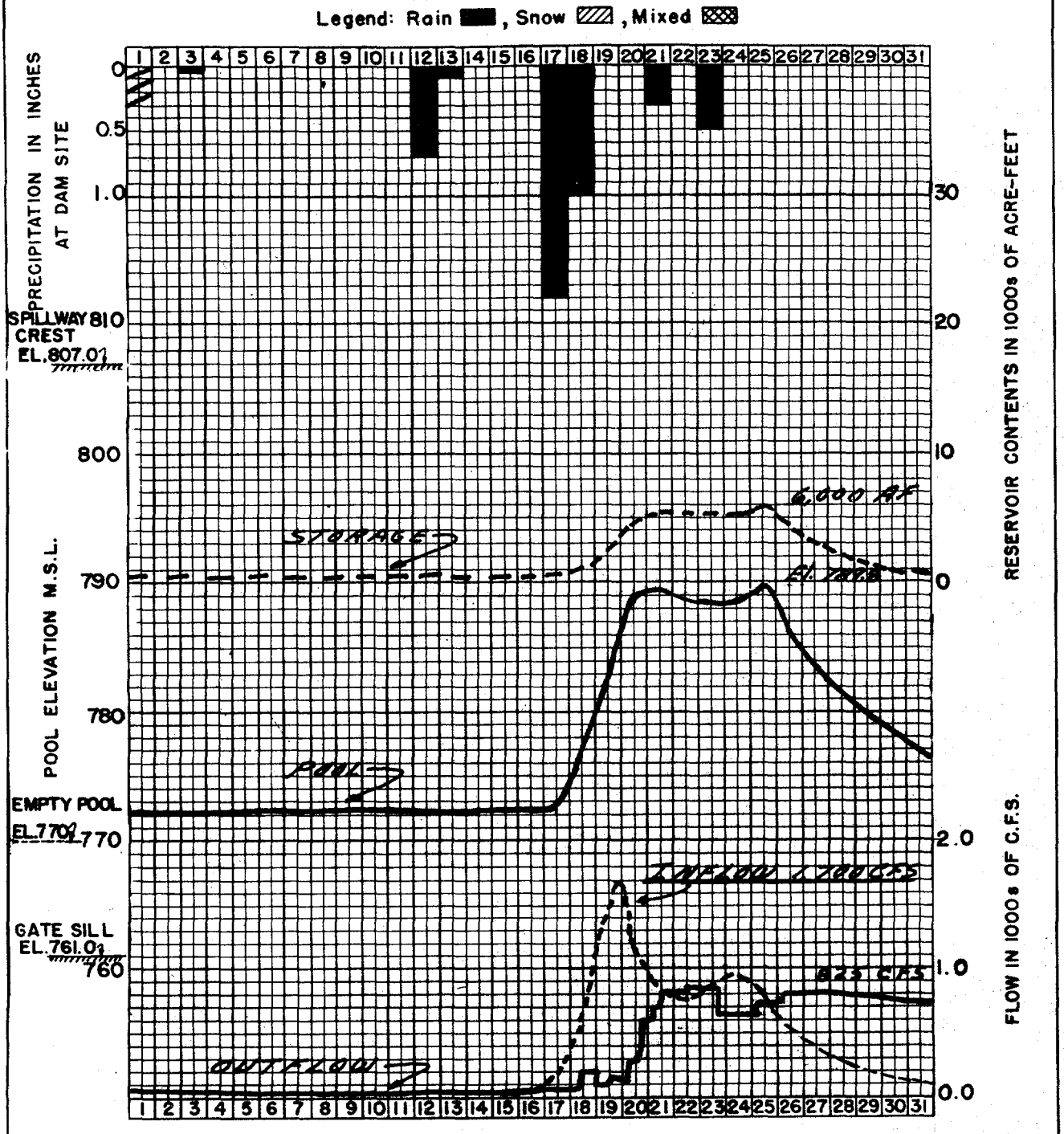
NEW ENGLAND DIVISION
WALTHAM, MASS.

	ELEVATION M.S.L.	STAGE FEET	NET STORAGE AC-FT
Gate Invert	625.0	0	0
Recreation Pool	641.0	16	1500
Spillway Crest	668.0	43	20500

Outlet Capacity at Full Pool = 1,030 c.f.s.

PLATE 22

Control Approval Symbol ENGNV-1



MONTH OF MAR. 1968

	ELEVATION	GROSS STORAGE Ac. Ft.
Conservation Pool	NONE	
Full Pool	807.0	24,000

Outlet Capacity at Full Pool 3,000 c.f.s.

Invert Elevation at Intake 761.0 ft. m.s.l.

MONTHLY RESERVOIR OPERATION

BARRE FALLS RESERVOIR

CONNECTICUT RIVER BASIN

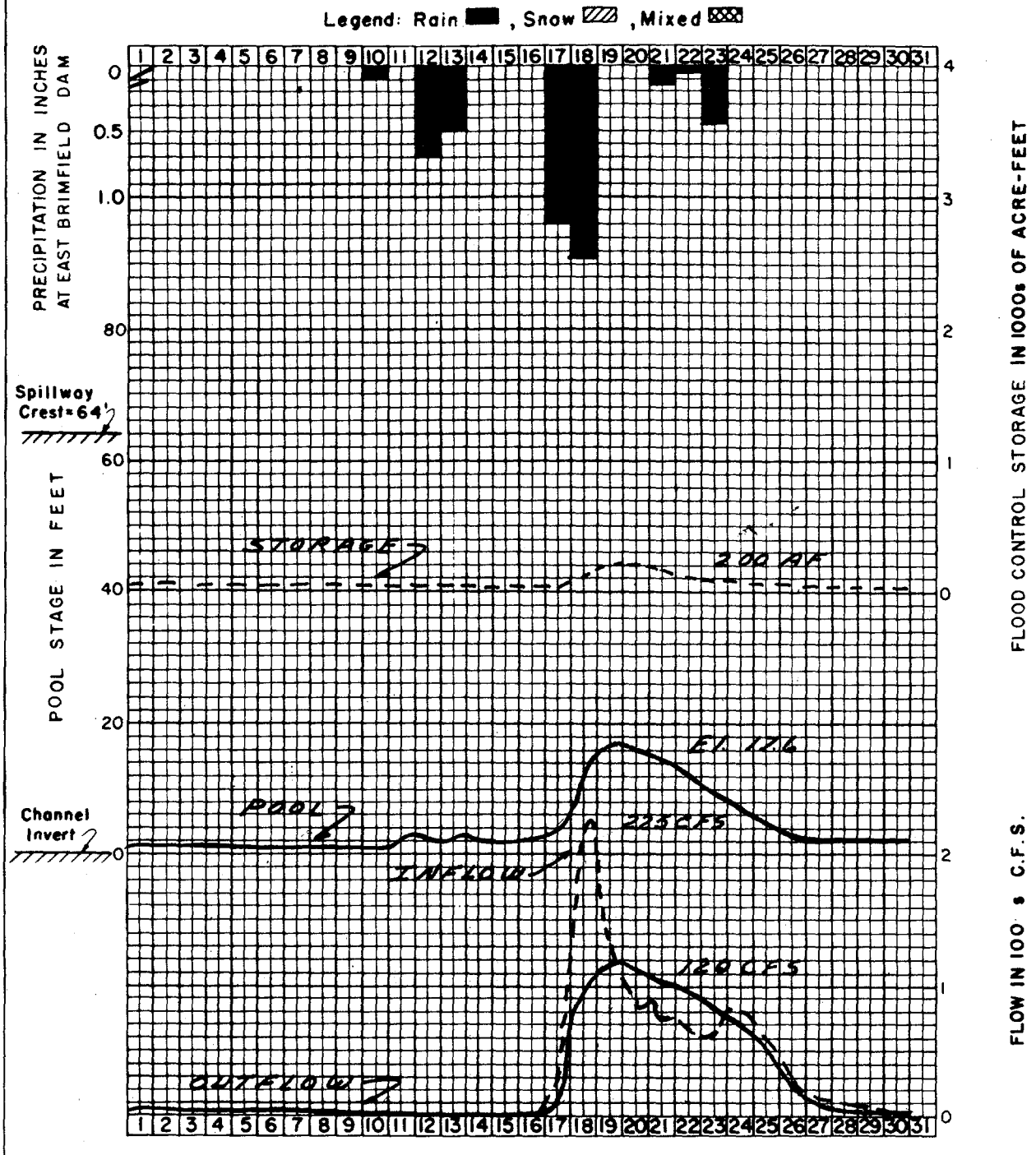
D.A. 55 SQ. MILES

NEW ENGLAND DIVISION
BOSTON, MASS.

PLATE 23

U.S. ARMY CORPS OF ENGINEERS

REPORTS CONTROL SYMBOL ENGCW- E-6



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

CONANT BROOK RESERVOIR

CONNECTICUT RIVER BASIN

D.A. = 7.8 SQ. MILES

	ELEVATION M.S.L.	STAGE FEET	NET STORAGE AC-FT
Channel Invert	693	0	0
Permanent Pool	None	—	—
Spillway Crest	757	64	3,740

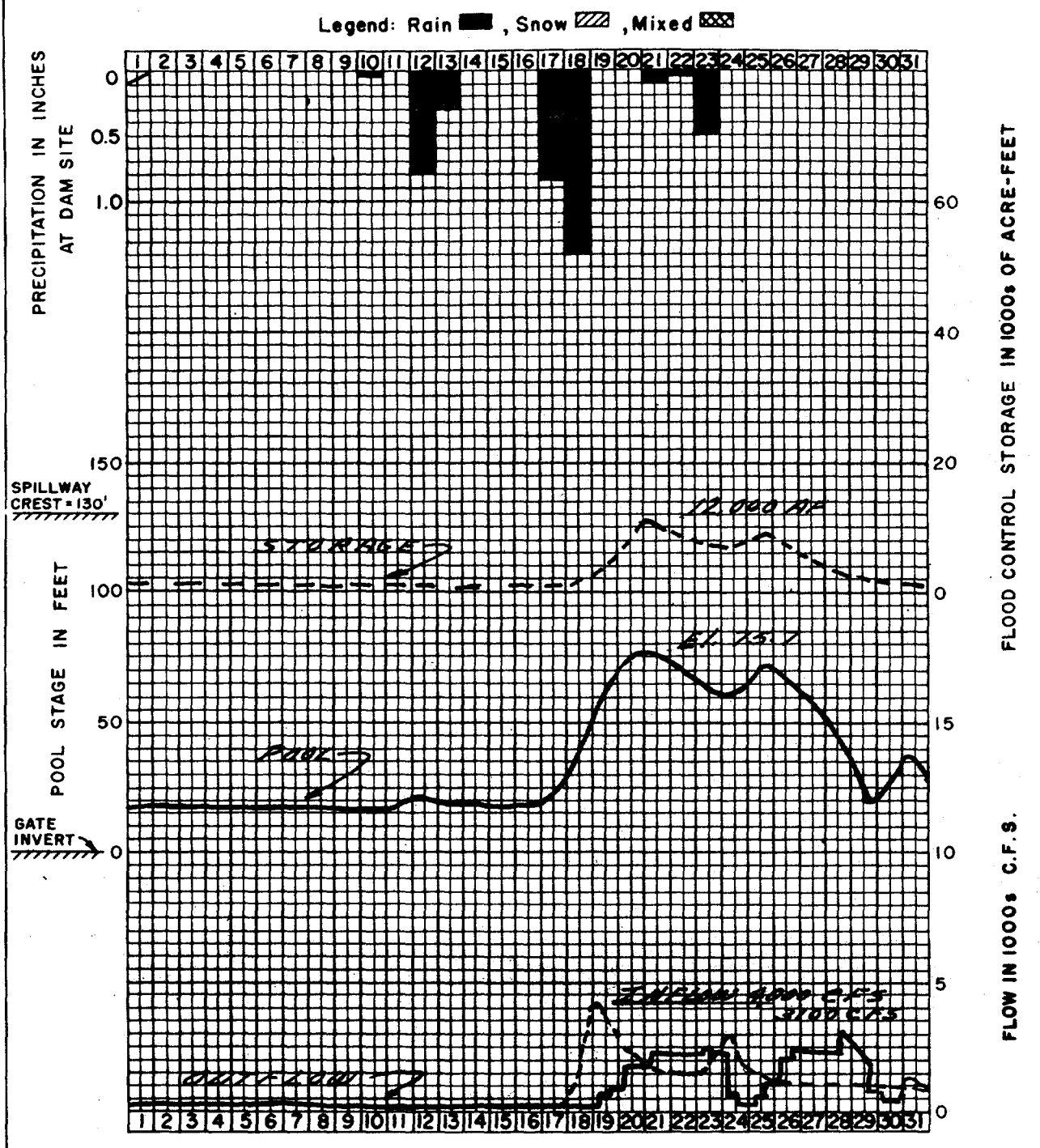
Outlet Capacity at Full Pool = 225 C.F.S.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 24

U.S. ARMY CORPS OF ENGINEERS

Reports Control Symbol ENGCW-E-6



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

KNIGHTVILLE RESERVOIR

WESTFIELD RIVER BASIN

D.A. = 162. SQ. MILES

	ELEVATION M.S.L.	STAGE FEET	NET STORAGE AC-FT
Gate Invert	480	0	0
Permanent Pool	NONE	—	—
Spillway Crest	610	130	49,000

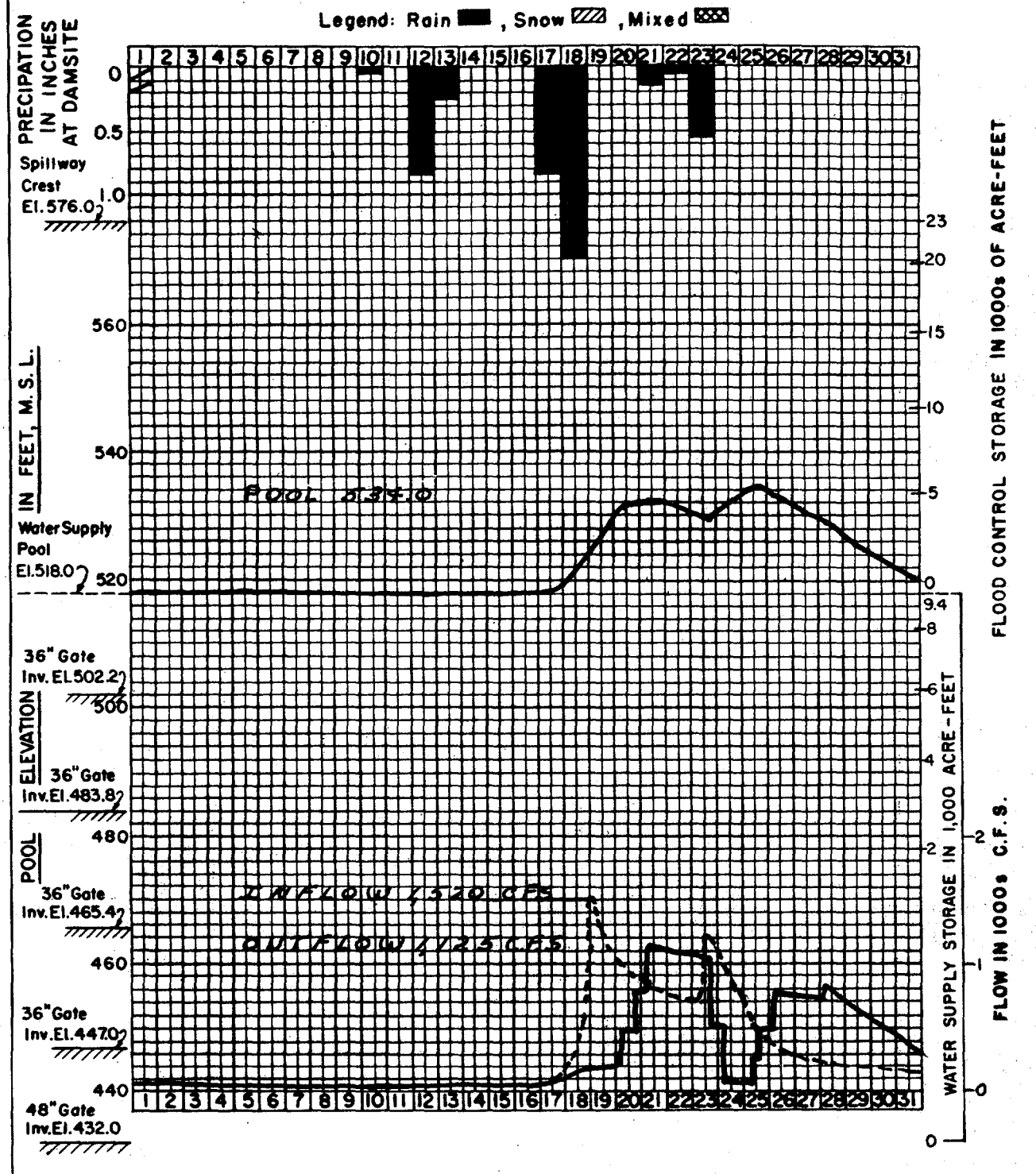
Outlet Capacity at Full Pool = 15,000 C.F.S.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 25

U.S. ARMY

REPORTS CONTROL SYMBOL ENGCW—E-6



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

LITTLEVILLE RESERVOIR

CONNECTICUT RIVER BASIN

D.A. = 52.3 SQ. MILES

	ELEVATION M.S.L.	STORAGE WATER SUPPLY AC-FT.	STORAGE FLOOD CONTROL AC-FT.
Gate Invert	432.0	0	—
Permanent Pool	518.0	9400	0
Spillway Crest	576.0	—	23,000

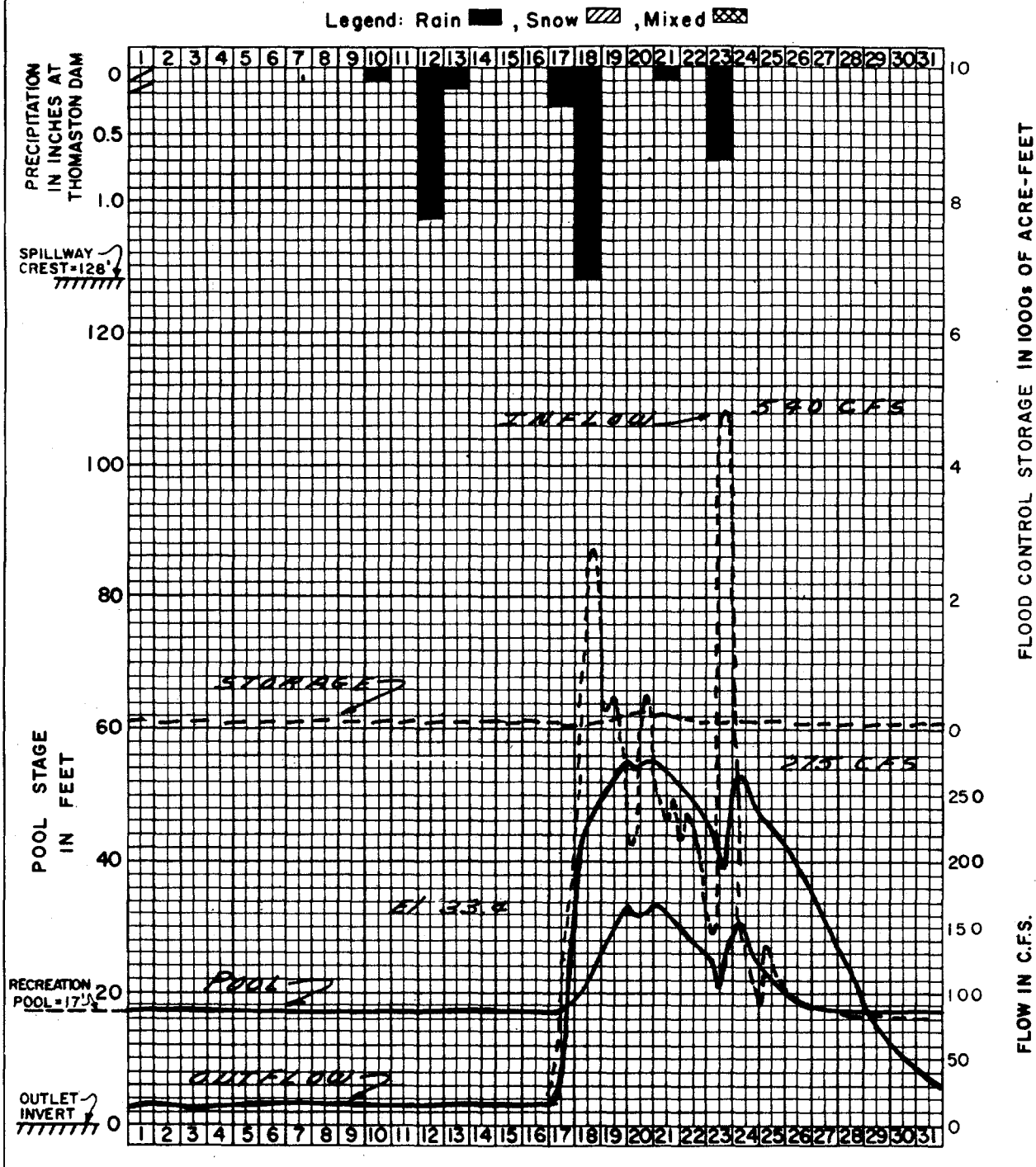
Flood Control Outlet Capacity at Full Pool = 2175 C.F.S.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 26

U.S. ARMY CORPS OF ENGINEERS

Reports Control Symbol ENGCW-E-6



MONTH OF MAR 1968

MONTHLY RESERVOIR OPERATION

MAD RIVER RESERVOIR

CONNECTICUT RIVER BASIN

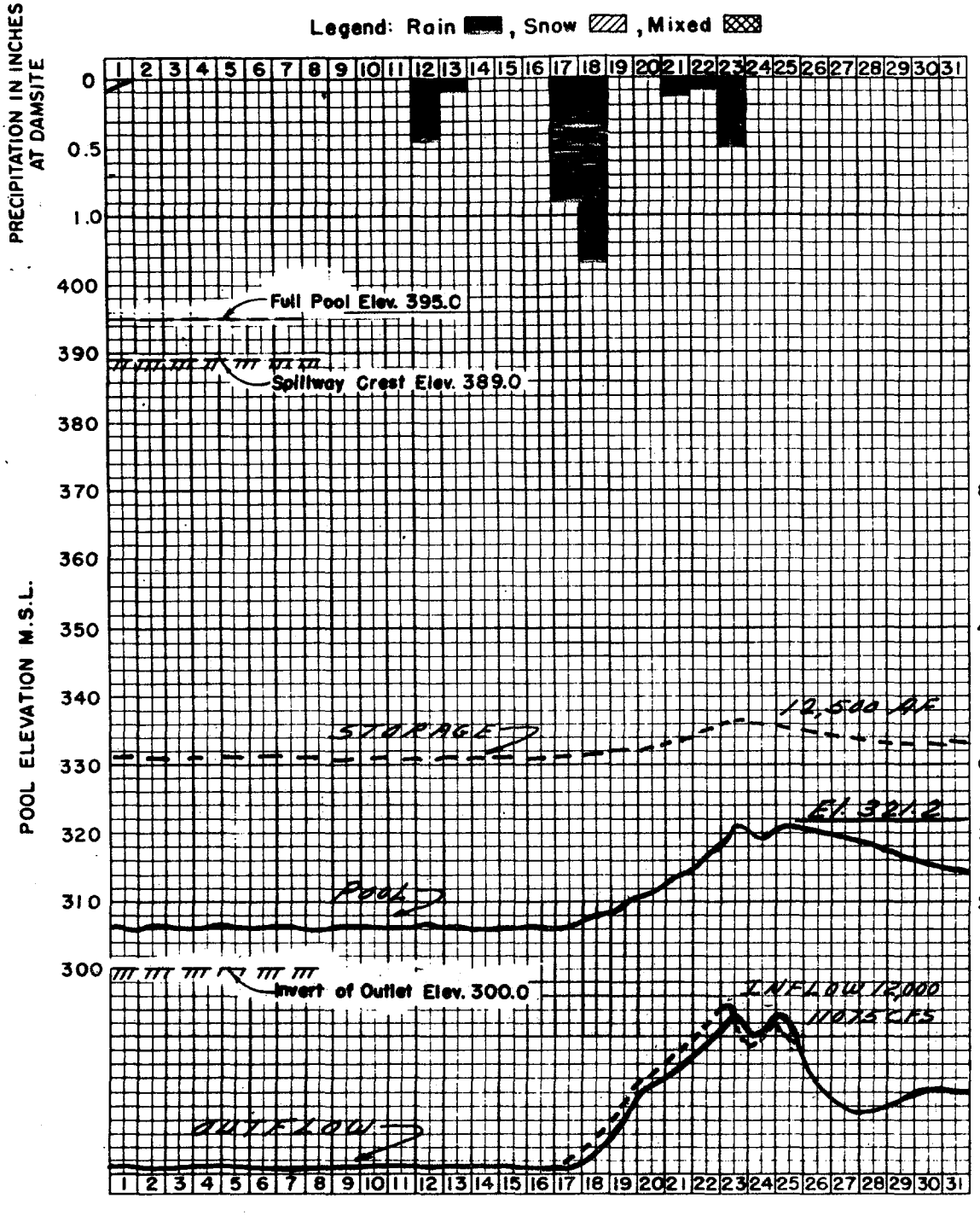
D.A. = 18.2 SQ. MILES

	ELEVATION M.S.L.	STAGE FEET	GROSS STORAGE AC-FT
Outlet Invert	855	0	65
Permanent Pool	872	17	190
Spillway Crest	983	128	9,700

Outlet Capacity at Full Pool = 435 C.F.S.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 27



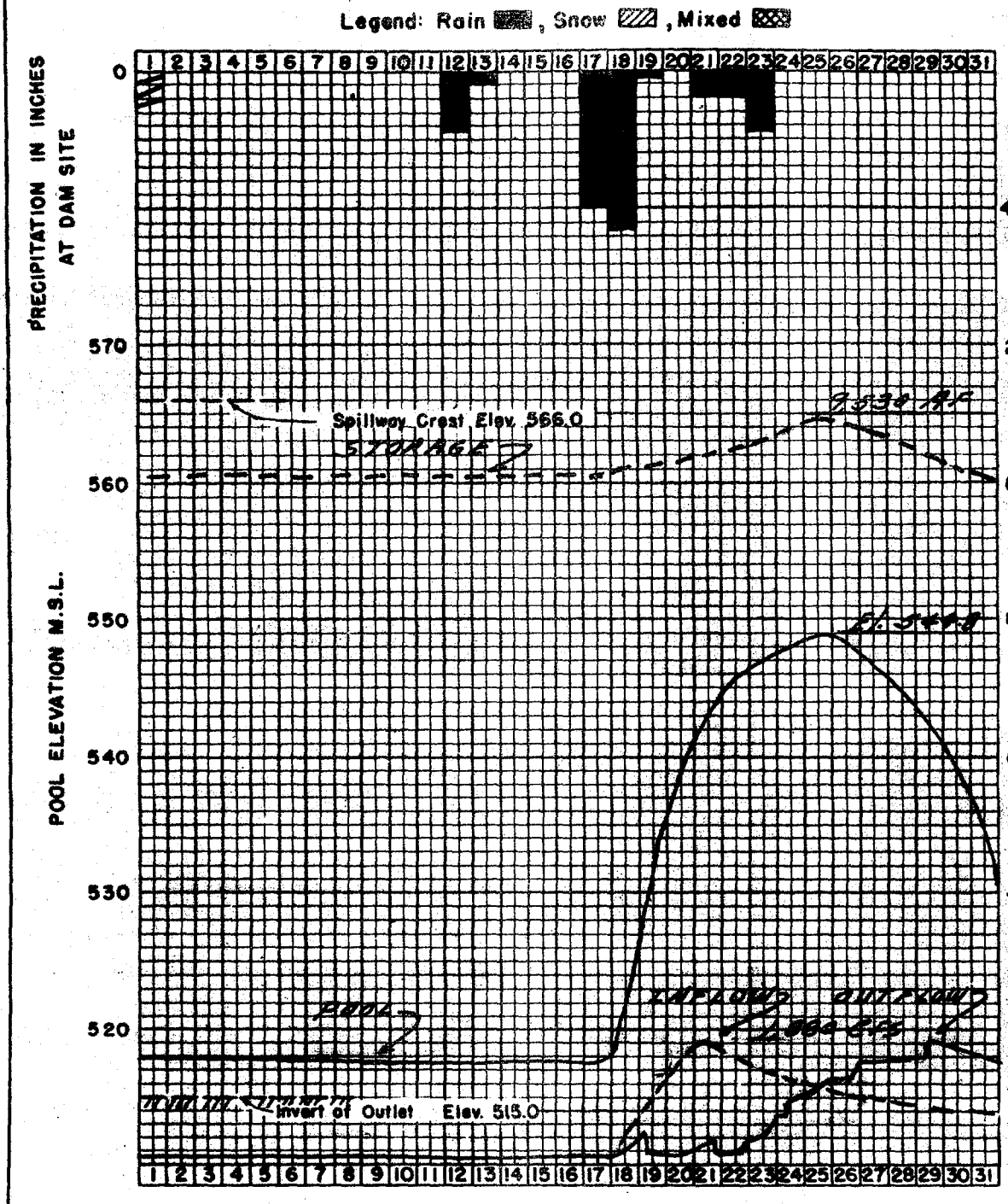
MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

FRANKLIN FALLS RESERVOIR
PEMIGEWASSET RIVER BASIN
D.A. 1000 SQ. MILES

NEW ENGLAND DIVISION
BOSTON, MASS.

	ELEVATION	GROSS STORAGE Ac. Ft.
Pool, Ordinary Flow	307.0±	3000
Pool at Spillway Crest	389.0	154000
Full Pool	395.0	170000
Outlet Capacity with Pool at Spillway Crest	42,000 c.f.s.	
Maximum Regulated Outlet Discharge	18,500 c.f.s.	



MONTH OF MAR. 1968

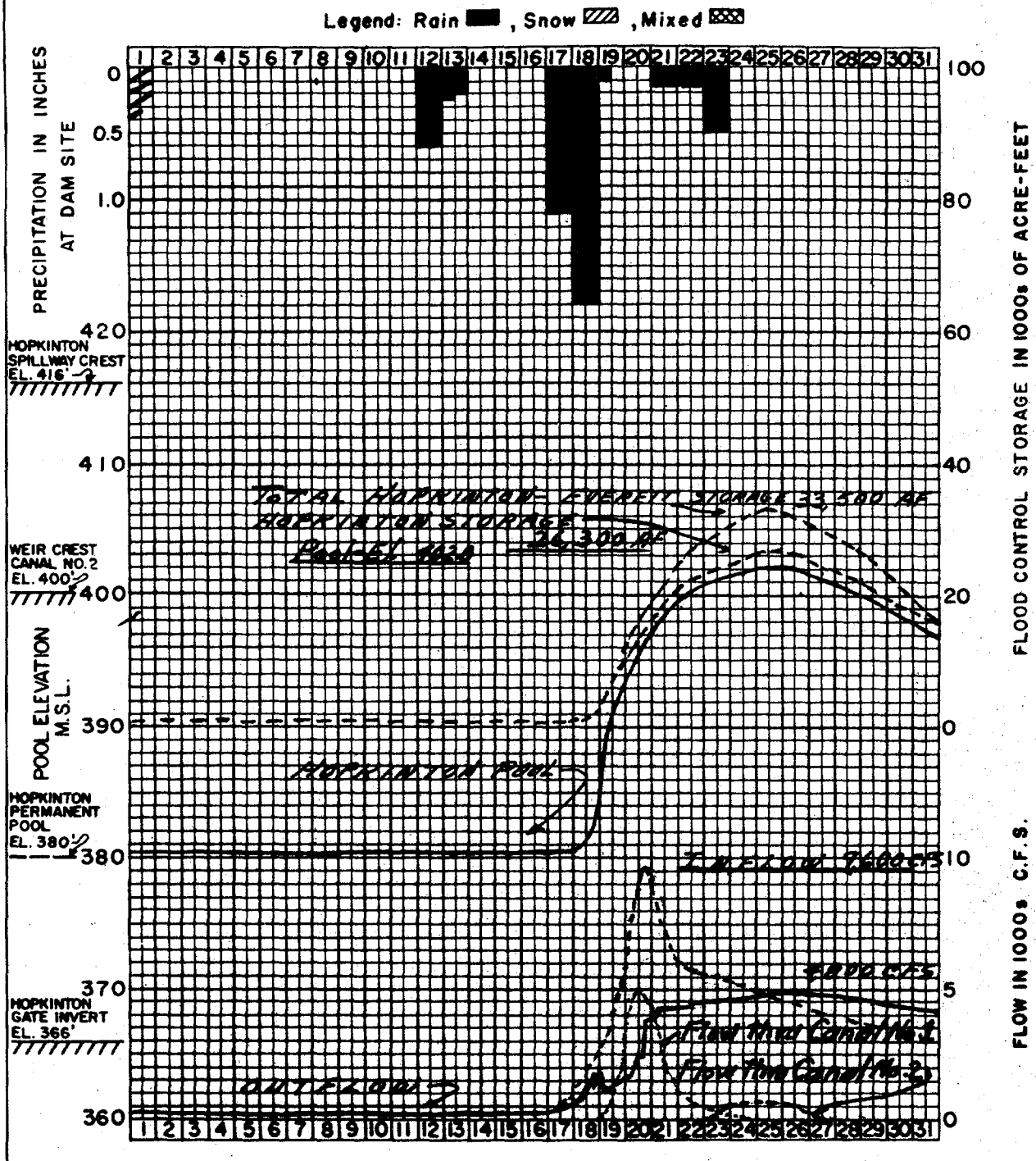
	ELEVATION	GROSS STORAGE Ac. Ft.
Low Flow Pool	518.±	0
Full Pool	566.0	46,000

Outlet Capacity at Full Pool 2800 c.f.s.

MONTHLY RESERVOIR OPERATION

BLACKWATER RESERVOIR
BLACKWATER RIVER BASIN
D.A. 128 SQ. MILES

NEW ENGLAND DIVISION
BOSTON, MASS.



MONTH OF MAR 1968

(PAGE 1 OF 2)

GROSS STORAGE IN ACRE FEET

	Hopkinton Reservoir	Everett Reservoir	Hopkinton-Everett Reservoir
GATE INVERT	0	0	0
PERMANENT POOL	700	1,000	1,700
WEIR CREST-CANAL NO. 2	23,500	48,500	72,000
SPILLWAY CREST(HOPKINTON)	70,800	86,500	157,300

HOPKINTON OUTLET CAPACITY (POOL AT ELEV. 416)= 14,000 C.F.S.
EVERETT OUTLET CAPACITY (POOL AT ELEV. 416)= 3,000 C.F.S.

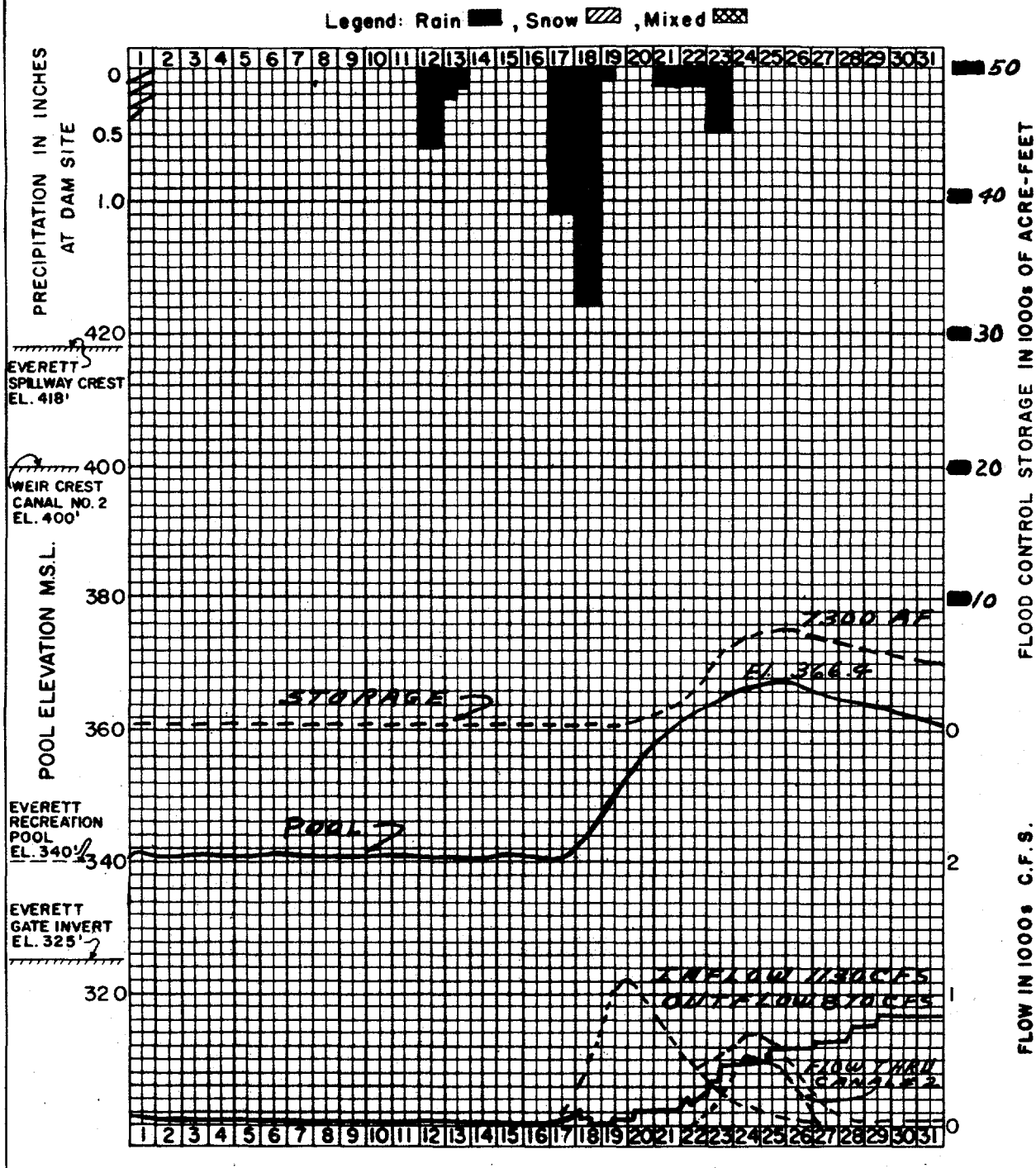
MONTHLY RESERVOIR OPERATION

HOPKINTON-EVERETT RESERVOIR
MERRIMACK RIVER BASIN
HOPKINTON RESERVOIR
CONTOOCOOK RIVER, N.H.
D. A. = 426 SQ. MILES

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 30

Reports Control Symbol ENGCW-E-6



MONTH OF MAR. 1968
(PAGE 2 OF 2)

MONTHLY RESERVOIR OPERATION

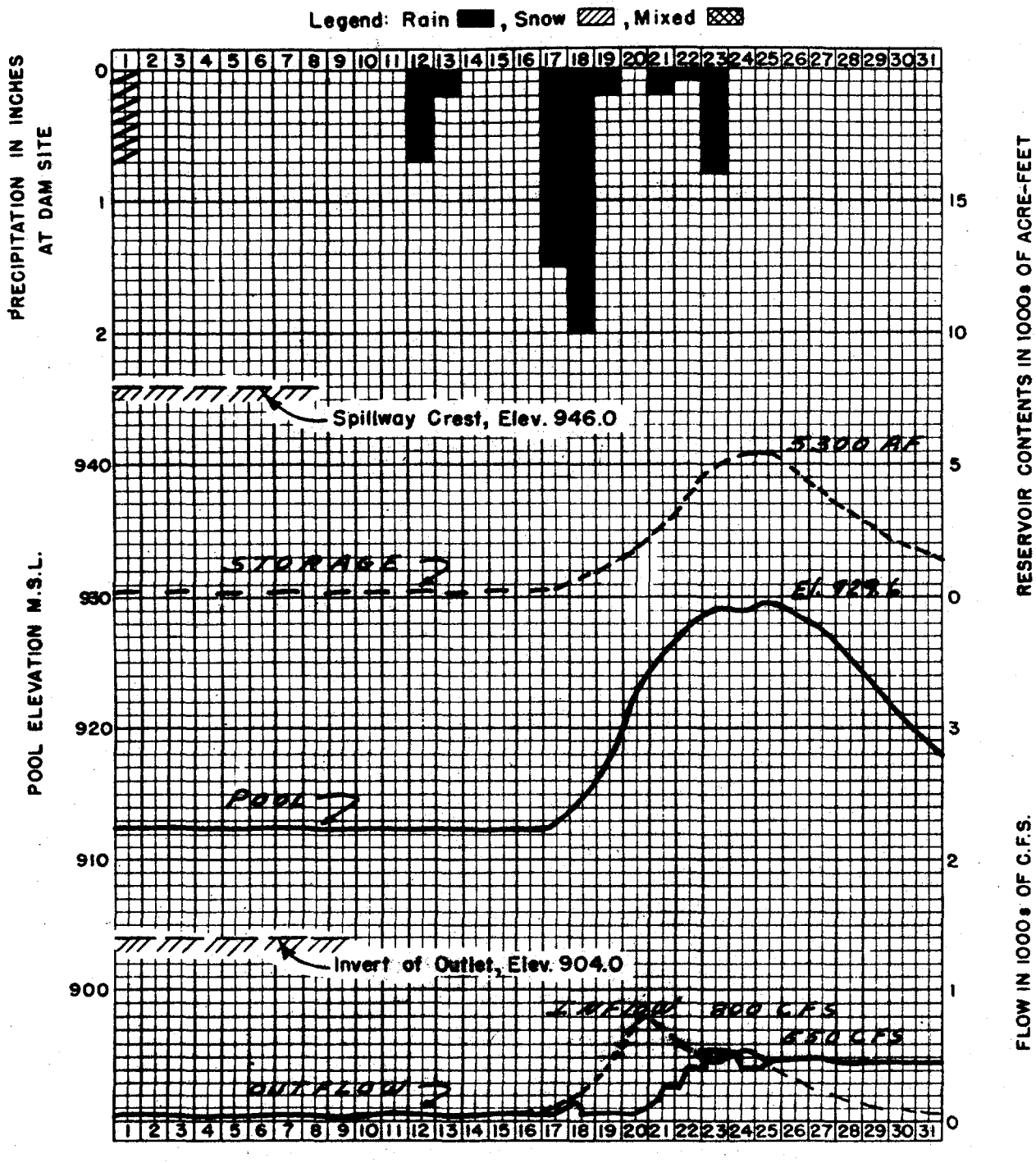
HOPKINTON - EVERETT RESERVOIR
MERRIMACK RIVER BASIN
EVERETT RESERVOIR
PISCATAQUOG RIVER, N.H.
D.A. = 64 SQ. MILES

	GROSS STORAGE IN ACRE FEET		
	Hopkinton Reservoir	EVerett Reservoir	Hopkinton - Everett Reservoir
GATE INVERT	0	0	0
PERMANENT POOL	700	1,000	1,700
WEIR CREST - CANAL NO. 2	23,500	48,500	72,000
SPILLWAY CREST (HOPKINTON)	70,800	86,500	157,300

HOPKINTON OUTLET CAPACITY (POOL AT ELEV. 416) = 14,000 C.F.S.
EVERETT OUTLET CAPACITY (POOL AT ELEV. 416) = 3,000 C.F.S.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 31



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

EDWARD MACDOWELL RESERVOIR

MERRIMACK RIVER BASIN

D.A. 44 SQ. MILES

ELEVATION

Low Pool 911.2 (Top of downstream flashboards)

Full Pool 946.0 12,800 Ac. Ft.

Outlet Capacity at Full Pool 1760 c.f.s.

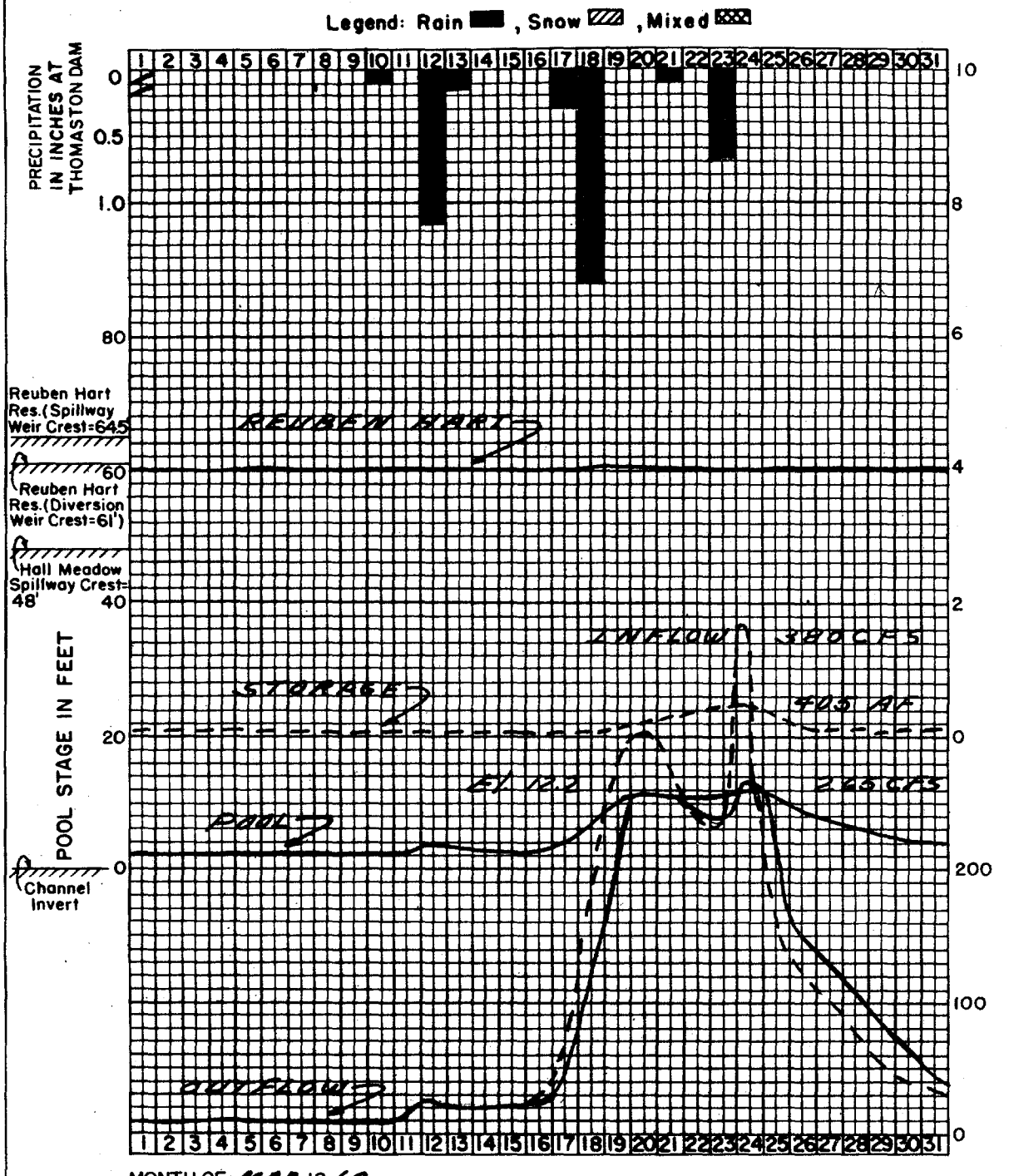
Invert Elevation at Intake 904.0 ft. m.s.l.

NEW ENGLAND DIVISION

BOSTON, MASS.

PLATE 32

Reports Control Symbol ENGCW-E-6



MONTH OF MAR 1968

MONTHLY RESERVOIR OPERATION

HALL MEADOW BROOK RESERVOIR
HOUSATONIC RIVER BASIN
HALL MEADOW BROOK, CONN.

	ELEVATION (M.S.L.)	STAGE (FEET)	GROSS STORAGE (AC-FT)
HALL MEADOW RESERVOIR:			
OUTLET INVERT	842	-	-
CHANNEL INVERT	850	0	0
SPILLWAY CREST	898	48	8,620

OUTLET CAPACITY AT FULL POOL = 455 C.F.S. (POOL EL. 898.0)

DRAINAGE AREA:

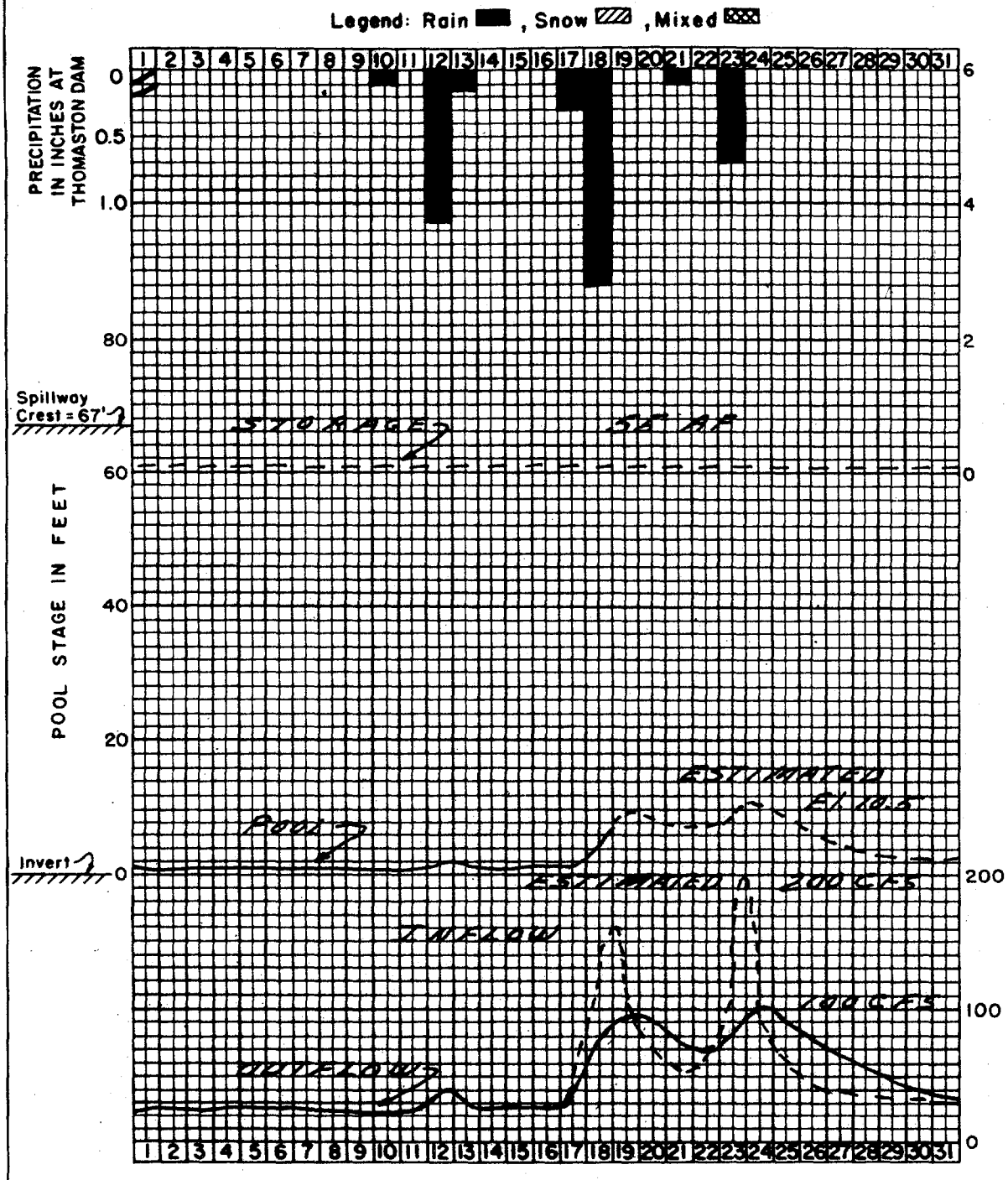
HALL MEADOW BROOK	12.2 SQ. Miles
HART BROOK	5.0 " "
TOTAL	17.2 SQ. Miles

REUBEN HART RESERVOIR:				
DIVERSION WEIR CREST	911	61	0	(FULL WATER SUPPLY POOL)
SPILLWAY WEIR CREST	914.5	64.5	440	(SURCHARGE STORAGE)

NEW ENGLAND DIVISION
WALTHAM, MASS.

U.S. ARMY

Reports Control Symbol ENGCW-E-6



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

EAST BRANCH RESERVOIR

HOUSATONIC RIVER BASIN

D.A. = 9.3 SQ. MILES

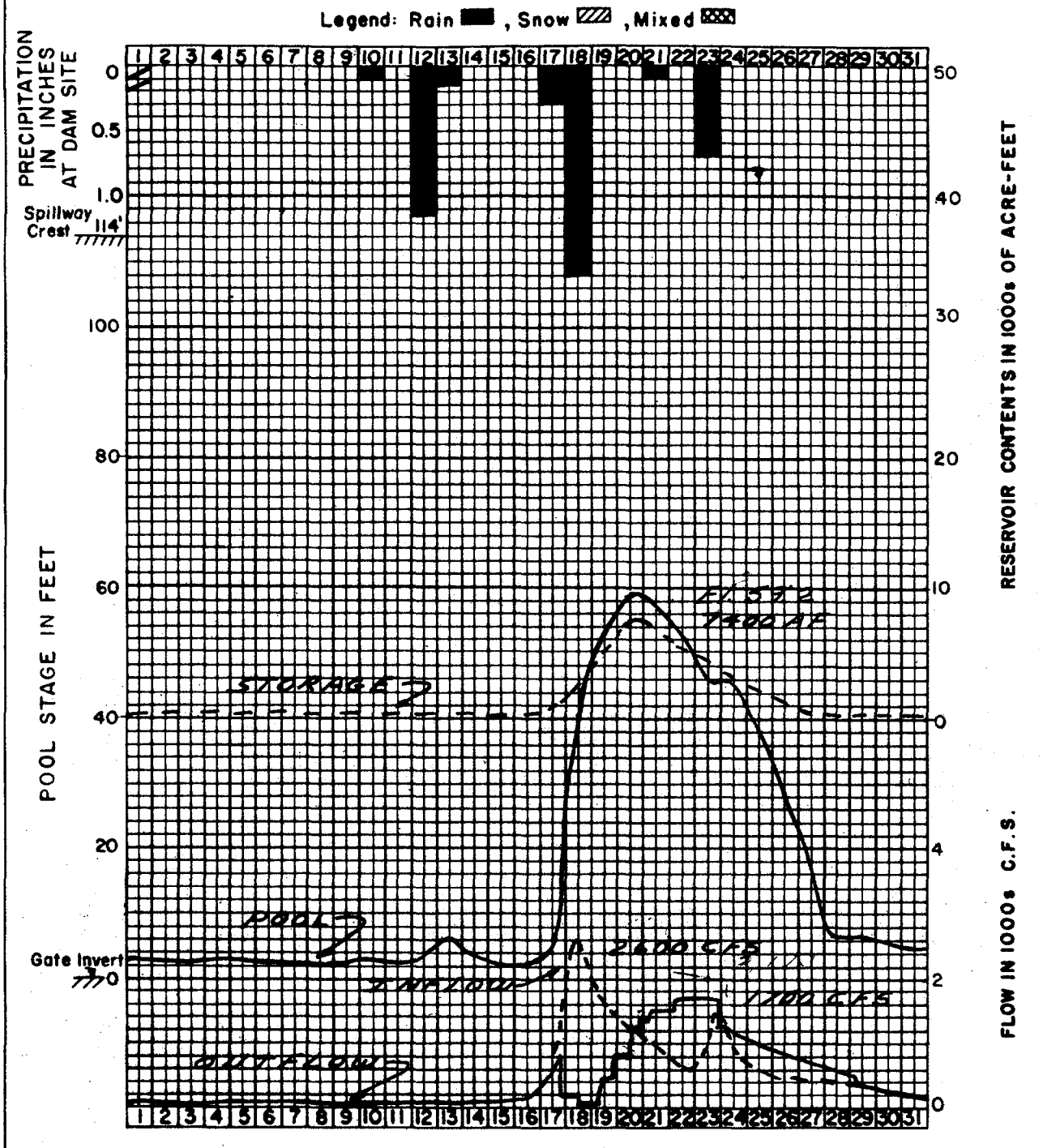
	ELEVATION M.S.L.	STAGE FEET	NET STORAGE AC-FT
Channel Invert	798.0	0	0
Permanent Pool	None	-	-
Spillway Crest	865.0	67.0	4,350

Outlet Capacity at Full Pool = 225 C.F.S.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 34

Control Approval Symbol ENGNV-1



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

THOMASTON RESERVOIR

NAUGATUCK RIVER BASIN

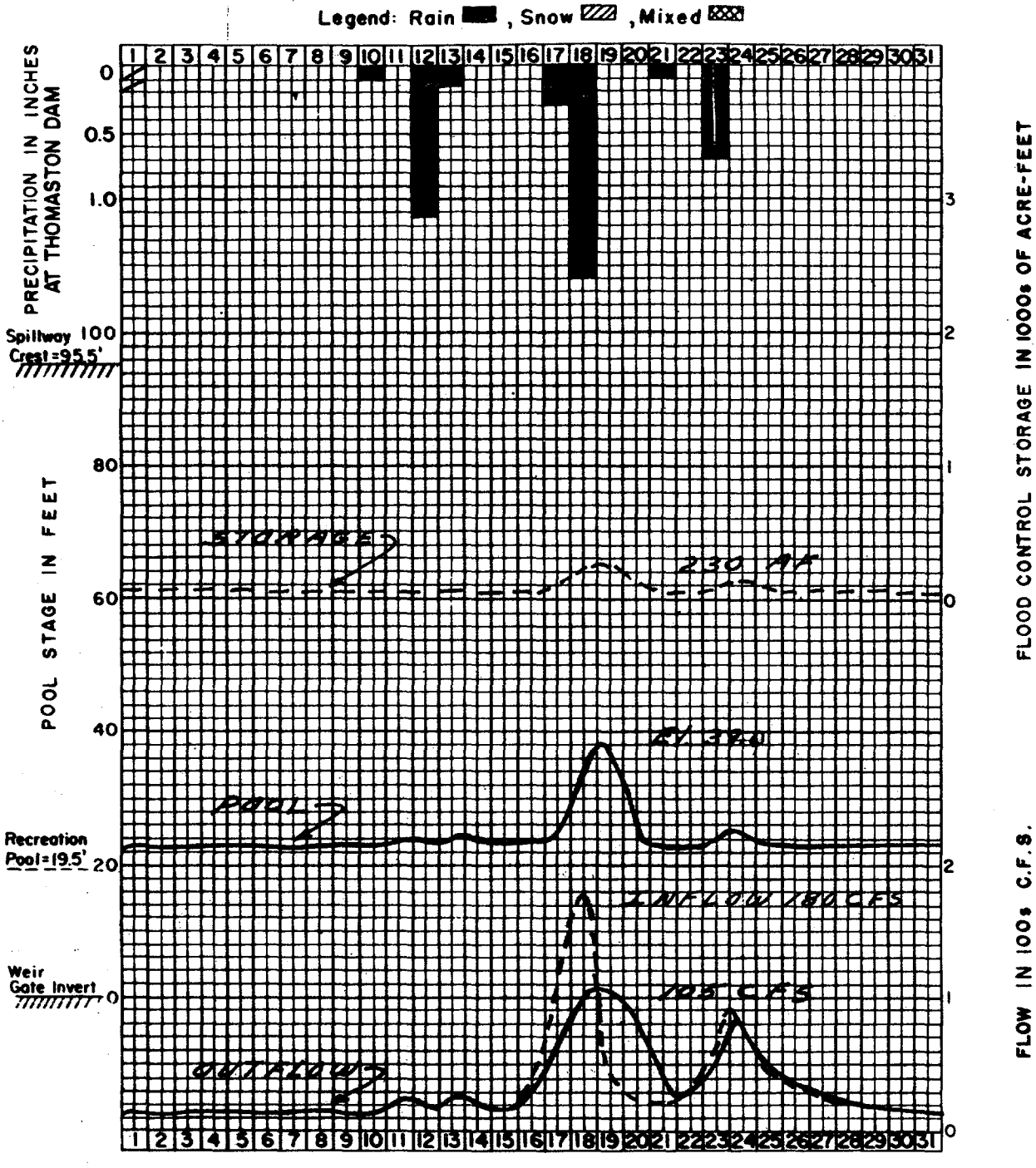
D.A. 97.2 SQ. MILES

	ELEVATION M.S.L.	STAGE FEET	STORAGE AC-FT
Gate Invert	380.0	0.0	0
Permanent Pool	——	——	None
Full Pool	494.0	114.0	42,000

Outlet Capacity at Full Pool = 5500 C.F.S.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 35



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

NORTHFIELD BROOK RESERVOIR

HOUSATONIC RIVER BASIN

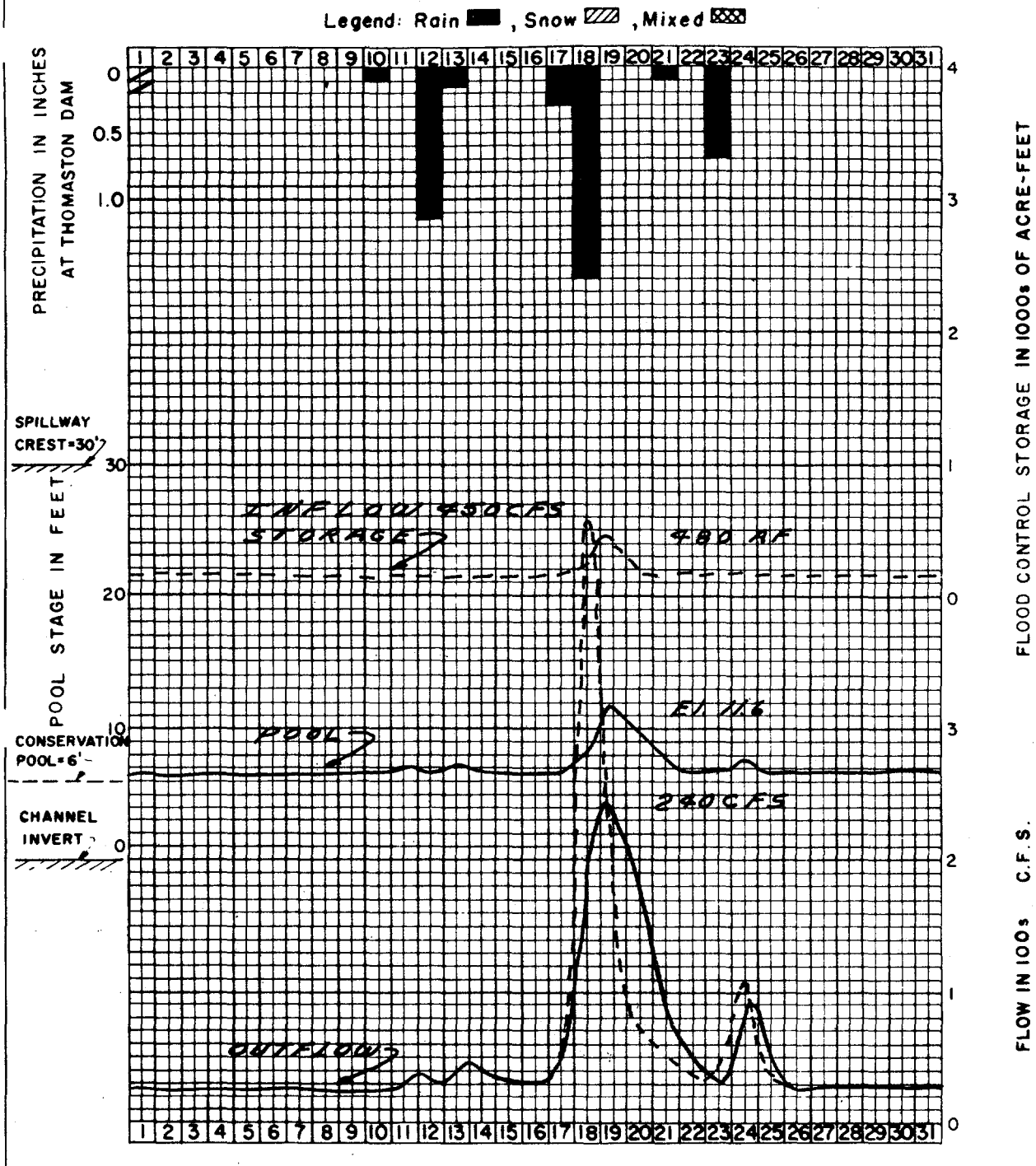
D.A. = 5.7 SQ. MILES

	ELEVATION M.S.L.	STAGE FEET	NET STORAGE AC-FT
Conduit Gate Invert	476.0	-	-
Weir Gate Invert	480.5	0	0
Recreation Pool	500.0	19.5	82
Spillway Crest	576.0	95.5	2,350

Outlet Capacity at Full Pool = 160 C.F.S.

NEW ENGLAND DIVISION
WALTHAM, MASS.

Reports Control Symbol ENGCW-E-6



MONTH OF MAR. 1968

MONTHLY RESERVOIR OPERATION

HANCOCK BROOK RESERVOIR

HOUSATONIC RIVER BASIN

D.A. = 12 SQ. MILES

	ELEVATION M.S.L	STAGE FEET	NET STORAGE AC-FT
Channel Invert	454	0	0
Conservation Pool	460	6	130
Spillway Crest	484	30	3,900

Outlet Capacity at Full Pool = 377 C.F.S.

NEW ENGLAND DIVISION
WALTHAM, MASS.

PLATE 37